1879.

QUEENSLAND.

GEOLOGICAL FEATURES OF PART OF THE COAST RANGE BETWEEN THE DALRYMPLE AND CHARTERS TOWERS ROADS.

(PRELIMINARY REPORT RELATING TO)

Presented to both Houses o Parliament by Command.

Camp on Bowen Road, near Woodstock,
7th June, 1878.

Sir,

I have the honour to forward herewith "Preliminary Report, No. I., on the Geological Features of part of the Coast Range between the Dalrymple and Charters Towers roads."

It is my intention, if you approve, to send in future, short "preliminary reports," showing the progress of the Geological Survey from time to time, as occasion requires and opportunity offers.

In the rainy season, and at other times when field work has to be suspended, the preliminary reports and field notes, with the results of the examination of fossils and rock specimens, can be expanded and combined in larger memoirs, and illustrated with the maps which are indispensable in descriptive geology.

I have, &c.,

ROBERT L. JACK.

The Honourable the Minister for Mines, Brisbane.

GEOLOGICAL SURVEY OF NORTHERN QUEENSLAND.

PRELIMINARY REPORTS.

No. 1.

ON THE GEOLOGICAL FEATURES OF PART OF THE COAST RANGE BETWEEN THE DALRYMPLE AND CHARTERS TOWERS ROADS.

On my way to examine the Bowen River Coalfield, I resolved to travel by a somewhat circuitous route, over a district which I had been obliged to leave blank in the geological map accompanying my recent report on the country between the Charters Towers Goldfield and the coast.

Having ascended the Coast Range by the pass (Thornton's Gap) on the Dalrymple road, and followed the Keelbottom Valley as far as the Plum-tree Hotel, I struck eastward into the mountains, for the heads of the Fanning River.

For ten miles down the Keelbottom Valley the road winds through an undulating granite country, with isolated rounded hills and some low "tors."

An abrupt change in the form of the hills, as well as in the character of the vegetation, marks the transition from granite to sandstone. The sandstone strata met with here, belong to the formation referred to in the Charters Towers Report as the "Dalrymple and Dotswood beds," and are understood to occupy a position in the Devonian system, intermediate between the Burdekin Downs limestone and the spirifer and lepidodendron beds of the Star country. In addition to the limited areas at Dalrymple and Dotswood, I am now able to include in this formation the greater part of the Keelbottom Valley, up to the junction of Speed Creek, and a considerable portion of the hilly region known as Tabletop Downs.

Leaving the eastward bend of the Keelbottom River between the Plum-tree Inn and Speed Creek, to ascend the hills on the eastern side of the valley, several low ridges are crossed, composed of grey, greenish, and brownish sandstones, dipping at about 30 degrees to the east-south-east. The sandstones are generally in not very thick beds, are hard and tough, and occasionally weather spheroidally. Some of the red beds are easily recognisable as having been derived from the waste of granite. All the sandstones have a greater or less admixture of felspathic granules with the siliceous. Towards the base of the hills the sandstones become more conglomeratic than in the valley, the pebbles being of porphyry, quartzite, quartz, and various metamorphosed rocks (gneiss, slate, &c.)

The

The steep slope of the hill is of conglomerate. On the top is a thick, conspicuous bed of yellow, false-bedded sandstone. This is capped by amygdaloidal dolerite, about ten feet in thickness. The dolerite is again surmounted by yellow sandstone.

The strata, when followed into the hill-country, continue of a character very similar to those above described. Some of them would yield an admirably durable building stone, easy to quarry and dress.

The occurrence, among strata of this age, of contemporaneous igneous rocks, is an important step towards the elucidation of the geological history of the colony.

The sedimentary strata, when followed across their outcrop in ascending order, become gradually more and more mixed up with beds of volcanic lava (varying from dolerites to porphyrites) till towards the Fanning the intercalated sandstones are rarely met with. These ancient lava beds, especially the porphyrites, show indications of copper over a wide area. The Keelbottom Copper Mine occurs near the Plum-tree Hotel, in a flat where a mass of porphyrite decomposes into black soil. Several shafts have been opened up, and a good deal of malachite and azurite extracted. Native copper is also plentiful. The ores occur in leaders and strings of quartz penetrating the porphyrite. Operations were suspended when the workings reached the water level

To the east of the Fanning is a granite country, in which alluvial workings of gold have been carried on for some time. I had, however, to leave them unvisited for the present.

Mr. Chisholm, of the Plum-tree Hotel, who kindly guided me to the copper mine, informed me that he had found tin ore in creeks on the west side of Keelbottom River, between the hotel and the Star and Dotswood road.

At the head of Arthur's Creek, near Arthur's Peak, an auriferous reef is now being worked by Mr. Charles Williams, who is erecting machinery on the spot.

Following the Fanning River down to the station of the same name, after traversing a granite country for about eight miles, a bed of limestone was struck. This limestone, mainly a mass of corals, could be recognised at a glance as the equivalent of the "Lower Devonian" limestone of Burdekin Downs. Where first met with, to the north of the Fanning Station, the limestone dips south-south-east at 20 degrees east of the Fanning, its outcrop forms a semicircular band of low scrubby hills, and returns to the river at the old stockyard, five miles below the present station. Here the dip is to the west at 25 degrees; and as the outcrop occupies a belt of four miles in breadth, the total thickness of the limestone beds must be nearly 7,000 feet—a thickness rivalling that of the carboniferous limestone of the midland counties of England.

The base of the limestone is seen very near the granite, to the north of the present station paddock. Below the limestone beds are some of granitic sandstone with calcareous concretions. In the sandstone, numerous impressions of gastropodous shells were seen, but they were too tender to handle.

From the limestone, at its outcrop near the old station, I obtained (besides corals) a few specimens of brachiopoda· The top of the limestone, a calcareous shale, showed the impression of a lepidodendroid stem, and yielded specimens of corals and mollusca.

The ring of limestone forms the outermost and lowest bed of a basin of stratified deposits. These consist for the most part of grey, brown, and greenish flaggy sandstones, and greenish shales. A few beds are white and very well suited for building purposes. From one of these white beds I obtained a portable specimen of a small lepidodendroid plant. The axis of the basin occurs in the river, about two miles above the old station.

I have very little doubt that the sandstones overlying the limestone are the equivalents of the lower parts of the "Dalrymple and Dotswood" series—the order of superposition which I inferred from what I saw of these deposits in November last.

Although the fossils have yet to be determined, I think it may already be safely predicted, from the presence of lepidodendron, not only in the limestone, but even in the overlying sandstones, that the whole series will turn out to be not older than Lower Devonian.

I was informed by Mr. Abbott, the courteous manager at the Fanning Station, that the limestone range contains numerous fine "spar caves." Some of these, it might be worth while to explore for remains of man and other mammalia.

Keeping in a direct line from the old station to Cunningham's Waterholes on the Charters Towers road, just above the pass leading up from the Houghton Valley, after the limestone ridges have been traversed, an open, gently undulating, well grassed, red granite country extends for about ten miles on the top of the table-land. A vein of gypsum, three feet broad, was traced for about a quarter of a mile from north-west to south-east. A basalt dyke was also observed, intersecting the granite from north-north-east to south-south-west.

In my Report on the Charters Towers district, I described a deposit of sandstone capping a granite hill on the edge of the range south of the Houghton, and stated that I had obtained no clue to its geological position. With a view to supplying this desideratum, I continued the traverse of the table-land on the top of the range in a nearly straight line from Cunningham's Waterholes to the top of the pass on the Dalrymple road. To my surprise, I found nothing but granite along the line traversed. The sandstone dips to the south on the northern edge of the range. Had this dip continued, I should have found the superincumbent strata (whatever there might be) along the line of my traverse. Had the dip on the other hand been reversed, I should have found the sandstone itself cropping up on the line traversed. Neither of these being the case, the sandstone must be presumed to be bounded on the south by a fault, and its position in the geological scale is as obscure as ever.

There is some likely looking quartz scattered in fragments on the top of the range between the Charters Towers and Ravenswood roads. Fair "colours" have been obtained in most of the gullies. About midway between the two roads, reefing was tried on a small scale about three years ago. Leaders and strings of quartz, a few inches in thickness, have been followed from the surface. A shaft has also been sunk on the underlie (south) side, obviously in the hope that the leaders would come together and form a workable reef—a hope which, apparently, has not been realised. The quartz is said to have yielded fifteen pennyweights of gold to the ton. It is frequently crystalline, with cavities filled up with decomposed pyrites, or simply coated with peroxide of iron.

At the request of Mr. Delisser, Engineer in charge of the survey of the Townsville and Charters Towers Railway, I halted at his camp on the Reid River, and under his guidance visited the hills on the west side of the "Reid Gap."

The

The hill to the north of Torrent Creek is capped by a stratified deposit. The lowest strata are limestone, of a total thickness of about sixty feet, divided by occasional thin layers of hardened mudstone. The deposit varies in quality from top to bottom, some strata being dark-blue limestone, and others white saccharine marble. Some of the blue beds are full of fossil corals.

Above the limestone is a thickness of about forty feet of grey hardened mudstones, with calcareous bands. The latter often weather out, leaving the rock a mere skeleton, which rings like an anvil under foot.

Mr. Delisser proposes that the hill should be reserved on account of the limestone, which lies so conveniently that it could be sent down in shoots almost to the side of the surveyed railway. The great value of the deposit fully justifies this recommendation.

The strata on this hilltop strike west 30 degrees north, and dip to north 30 degrees east.

From the hilltop I could see distinctly that the hill on the east side of the gap was likewise composed of stratified deposits, and I made the ascent, accompanied by Mr. Delisser. We found this hill to be capped by a continuation of the strata observed on the summit of the first hill (the deep gap between having been denuded).

The strata observed here were as follows :—

Hardened white sandstone or quartzite, partly conglomeratic, three feet.
Sandstone (thickness uncertain).
Good blue limestone, with corals, say thirty feet.
The strata seen on first hill.—Hard mudstones and fine grained hardened sandstones (almost quartzites), with limestone in bands along bedding-planes, say eighty feet.
Good blue limestone (base concealed by talus).

The limestone could be shot down from this hill to the railway line, almost as easily as from the hill on the opposite side of the gap.

On leaving the railway camp next morning for the Bowen road, I went *viâ* Landsdowne Hotel and Serpentine Station, for the purpose of seeing the part of the Coast Range lying between the Reid and Ross Rivers—a district over which I had only travelled once, by coach in the night, and to whose structure Mr. Delisser's discovery at the Reid Gap had afforded a new and unexpected clue.

After passing Cobb and Co.'s stables at Double-barrel Creek, I was gratified by the view of an outcrop of limestone high up on one of the mountains to the left. The dip here is to the south-west. On approaching the mountains, it became evident that their whole mass consisted of stratified deposits, although only the beds on the hilltops were, as a rule, visible, the lower parts of the hills being concealed by a talus of *débris*. Two of the mountains which I ascended gave the following section :—

	Feet.
Dark-blue limestone, full of fossil coral (on hilltop), the lower part only divided by partings of quartzite. Thickness, at least	200
Alternate quartzite and limestone (or marble) bands, say	100
Blue greywacke	$1\frac{1}{2}$
Alternate quartzite and limestone bands	40
Dark-blue greywacke	5
Scrub, covering, perhaps, 20 feet of section	20
Limestone with quartzite bands along bedding-planes	40
Fine grained dark-blue greywacke	4
Impure saccharine marble, with dark streaks, much jointed; in one bed ...	15
Dark-blue coralline limestone, about	60
Dolenite-like greywacke (thickness unknown).	

Besides its value as mortar, the limestone, and possibly the greywacke (which is thick-bedded and free of joints), might be of value as a building stone. They could be easily quarried and shot down to the plain (as building-material of Dresden is shot down to the Elbe), and could be conveyed to Townsville by a level road only thirty-three miles long. I have not had an opportunity of communicating with Mr. Delisser since leaving his camp, and am not aware how near the railway line approaches to the hills in question—about three miles, I imagine. The economic importance of an inexhaustible supply of good limestone to a rising town, need not be pointed out.

Much less clear is the geological age of the deposits in question. The corals of the Double-barrel limestone remind one strongly of those which make up the mass of the Fanning and Burdekin Downs limestones. Some of them are certainly of the same genera, if not of identical species. There are, nevertheless, some strong points of contrast which may indicate that the deposits are by no means contemporaneous.

Whereas the Burdekin Downs and Fanning limestones have suffered no metamorphism, those of Double-barrel and Torrent Creeks are often altered to white marble.

The sandstones, &c., associated with the Double-barrel limestone are metamorphosed to quartzites and greywackes, whereas those of the Fanning district remain quite unaltered.

There is some reason to suppose that the Burdekin Downs and Fanning limestones were laid down in hollows already carved in the table-land; while, on the other hand, the Double-barrel and Torrent Creek limestones were deposited prior to the commencement of the denudation of the range.

As the Broken River limestone (the Burdekin Downs limestone) has been pronounced by Mr. R. Etheridge, F.R.S., to be of Low Devonian, if not of "Siluro-Devonian" age, the Double-barrel limestone, if it should turn out to be of older date, may have to be classed as Silurian.

A minute examination of the fossils, together with a further investigation of the strata which succeed the Double-barrel limestone, may solve the question of its geological horizon. The limestone appeared to me to dip under a thick limestone seen on a hill on the south side of Double-barrel Creek, and it is probable that a further traverse of this part of the range may reveal, not only interesting geological features, but also other deposits of economic importance.

ROBERT L. JACK.

Price 3d.]

By Authority: JAMES C. BEAL, Government Printer, William street, Brisbane.

1879.

QUEENSLAND.

BOWEN RIVER COALFIELDS.

(PRELIMINARY REPORT RELATING TO)

Presented to both Houses of Parliament by Command.

Camp, Bowen River, near Havilah,
18th July, 1878.

Sir,

I beg to enclose herewith Preliminary Report, No. II., "On the Bowen River Coalfields."

I have, &c.,
ROBERT L. JACK.

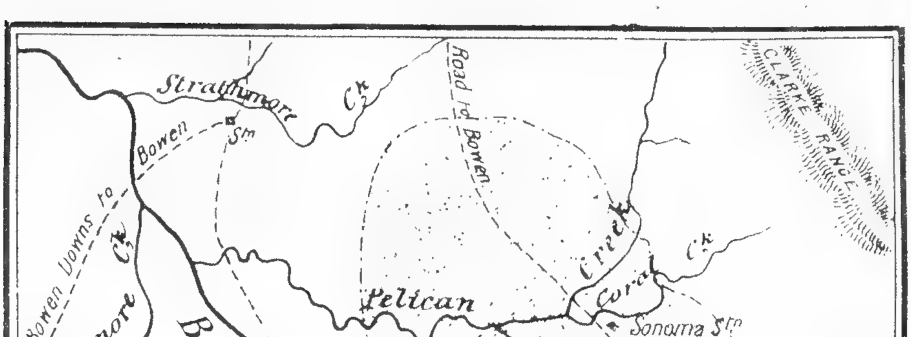
The Honourable the Minister for Mines, Brisbane.

GEOLOGICAL SURVEY OF NORTHERN QUEENSLAND.

PRELIMINARY REPORTS.

No. II.

ON THE BOWEN RIVER COALFIELD.



SKETCH MAP OF THE DISTRICT.
(*Scale 8 miles to the inch.*)
COAL AREA SHADED.

As the "Bowen River Coalfield," in all probability, extends, with slight interruptions, through six degrees of latitude, from the Bowen River to the heads of the Dawson, it has only been possible as yet to examine its northern extremity.

After defining the boundaries of the field, I have hitherto carried out the plan of examining minutely every creek and natural section. By this means I have not only gained an idea of the geological structure of a portion of the field, which may in future be usefully applied to the whole, but have been able to record the position of the outcrop of every coal-seam exposed to view.

Without entering into details, which had better be reserved for a fuller report after the investigation shall have been completed, I may say that I have observed, within the area indicated by shading on the above sketch-map, a good many seams of coal, several of them over ten feet in thickness, as well as oil-shale, ironstone, and alum-shale.

The strata have not been much disturbed from their original horizontality, having been thrown only into gentle undulations. They are "troubled" by very few "faults."

In chronological order, the deposits of the district are as follows:—

1st. Granite and other metamorphic rocks.

2nd. A considerable thickness of sandstone has been laid down on the granite, &c.

3rd. Volcanoes have broken out and have covered the sandstones with vast sheets of doleritic and porphyritic lavas and ashes. The outcrop of these lava and ash beds forms a great part of the Clarke and Leichhardt Ranges, and partly surrounds the coalfield.

4th. The sandstones, shales, and coal-seams have been gradually accumulated above the beds of lava and ashes.

5th. The volcanic activity was again renewed, and sheets of molten lava forced their way to the surface through lines of weakness in the stratified deposits. The coal-seams being unhappily such "lines of weakness," were in many cases utterly destroyed.

The dolerite, which was the agent of this destruction of the coal-seams, has assumed, as it usually does on coming in contact with carbonaceous strata, the form known to miners as "white trap."

Although, so far as I have yet seen, what would otherwise have been the most valuable seams in the field have been more or less damaged by the intrusion of the igneous rocks above referred to, it is in the highest degree likely that extensive and valuable deposits still remain uninjured. I have already seen some seams which have escaped, and all my experience in the "burnt" districts of the Scottish coal-fields leads me to believe that the "burning" of the seams must be only partial, and confined to limited areas.

I propose to spend ten days or a fortnight more in examining Jack's Creek, part of Rosella Creek, and a part of the Bowen River, east of the limits of the sketch-map. I shall then be in a position to say where capital may be most advantageously expended in "proving" the field, by boring or otherwise.

As there is some reason to believe that an outlying portion of the coalfield may be found between the Clarke Range and Bowen, I propose to return to the coast by the Don Valley, and to examine the district by the way.

In the belt of dolerites and porphyrites surrounding the coalfield, as above described, there appear to be considerable deposits of copper ore. Cursory traverses of this region (especially near the mouth of Pelican Creek and the Bowen River, up to Biralee) have furnished me with numerous specimens of the green carbonate, associated with zeolites, but have not revealed the existence of the ore in lodes.

Galena is said to occur in large quantities on Flagstone Creek (east of the area embraced in the map). I hope to visit this creek before returning to the coast.

I see no reason to doubt that this coalfield will one day rank high among the mineral riches of the colony, but that day may be long delayed by the expense of carriage to the coast. If there is no engineering difficulty in bringing the Bowen and Bowen Downs railway through the gap at the head of Pelican Creek, the minerals of the Bowen River district will certainly become available.

I have made collections of mineral and fossil specimens.

ROBERT L. JACK.

By Authority: JAMES C. BEAL, Government Printer, William Street, Brisbane.

1879.

QUEENSLAND.

REPORT

TO

THE HONOURABLE THE MINISTER FOR MINES

ON

THE BOWEN RIVER COALFIELD.

BY

ROBERT L. JACK, F.G.S., F.R.G.S.,
GEOLOGICAL SURVEYOR FOR NORTHERN QUEENSLAND.

WITH A GEOLOGICAL SKETCH-MAP.

PRESENTED TO BOTH HOUSES OF PARLIAMENT BY COMMAND.

BRISBANE:
BY AUTHORITY: JAMES C. BEAL, GOVERNMENT PRINTER, WILLIAM STREET.

REPORT ON THE BOWEN RIVER COALFIELD.

Geological Survey Office,
Townsville, 23rd November, 1878.

SIR,

I beg to lay before you my Report on the Bowen River Coalfield, with relative Map.

I have, &c.,

ROBERT L. JACK.

To The Honourable the Minister for Mines, Brisbane.

REPORT.

1. The Bowen River, flowing for more than 100 miles in a north-westerly direction, is the largest tributary received by the Burdekin after its emergence from the "gorge" by which it breaks through the Coast Range to the level country facing the Pacific Ocean.

2. The existence of a coalfield, stretching almost continuously from this river through six degrees of latitude to the heads of the Dawson, has been known for many years. Dr. Leichhardt, in 1845, found, on the Mackenzie River, in 23° S. latitude, masses of silicified coniferous wood "in the vicinity of beds of coal undistinguishable from those of the Hunter at Newcastle." The Rev. W. B. Clarke, in a paper read 2nd April, 1862,* refers to "representatives" of the coal beds of the Hunter River and Illawarra, "with the Newcastle coal plants," at the junction of the Comet and Mackenzie Rivers. In the same paper mention is made of the discovery of "permian or carboniferous" fossils from the Dawson River.

3. A letter from Mr. Daintree, to Mr. Clarke, regarding the fossils of the Bowen River Coalfield, printed in the Quarterly Journal of the Geological Society of London,† bears date 10th February, 1866. Again, in Daintree's important memoir on the Geology of Queensland,‡ reference is made to the coal area drained by the Dawson, Comet, Mackenzie, and Bowen Rivers, and to fossils of carboniferous age obtained by Mr. Clarke from the head of the Don River.||

4. From the heads of the Dawson River to the latitude of Bowen, the coalfield is separated from the coast by a mountain range. Owing to this barrier, and to the presence of timber enough to supply the wants of the scattered settlers in the neighbourhood of the field, no use, worth mentioning, has hitherto been made of the coal, nor has any serious attempt been made to ascertain its value, with the exception of the operations of the "Bowen River Coal Association," whose reports have been courteously handed to me, and will be found in Appendix B.

5. A glance at Daintree's geological map, first published (April, 1872) by the Geological Society of London, and afterwards issued "by authority" in Brisbane,§ will show that the longer axis of the coalfield lies nearly north and south, while the coast line trends N.N.W. and S.S.E. Consequently the formation approaches nearest to the coast at its northern end. This northern end, therefore, which happens to lie conveniently near the township of Bowen and harbour of Port Denison, naturally presents itself as the place where the question of the usefulness of the store of "fossil fuel" should first be put to the test. Having therefore, in the first place, laid down the boundaries of this part of the field, I visited every creek and natural section within the area thus defined, in order to obtain such a knowledge of the structure of the field as would be useful in further investigations.

6. The

* On the occurrence of Mesozoic and Permian Faunæ, in Eastern Australia.—Quart. Journ. Geol. Soc., Lond., XVIII., p. 244.

† Vol. XXIII., p. 11.

‡ Quart. Journ. Geol. Soc., Lond., XXVIII., p. 271 (1872).

|| This Don must not be confounded with the Don at Bowen. It lies 50 or 60 miles east of Gainsford, and flows into the Dawson.

§ An unfortunate mistake has been made in the Brisbane edition. The shading on the London map was far from distinct, and seems to have misled the Brisbane lithographer, who has coloured the Dawson-Bowen Coalfield as "mesozoic carboniferous," although from the London map and accompanying text, it is evident that "palaeozoic carboniferous" is meant. The effect is a total misrepresentation of Mr. Daintree's views. Mr. R. Brough Smyth, in his Geological Sketch Map of Australia, published (23rd April, 1873) by the Victorian Government, assigns a mesozoic age to the coalfield in question, whether from having inadvertently copied the lithographic map, or from adherence to Prof. McCoy's views regarding the age of the Australian coal measures generally, I am unable to say. Daintree's map is still the only published map of the geology of the colony, but another bringing our knowledge up to date is urgently required.

6. The following remarks on the

GEOLOGICAL STRUCTURE OF THE DISTRICT

will be best understood by referring to the diagram (fig. 1), and the geological sketch-map accompanying this Report :—

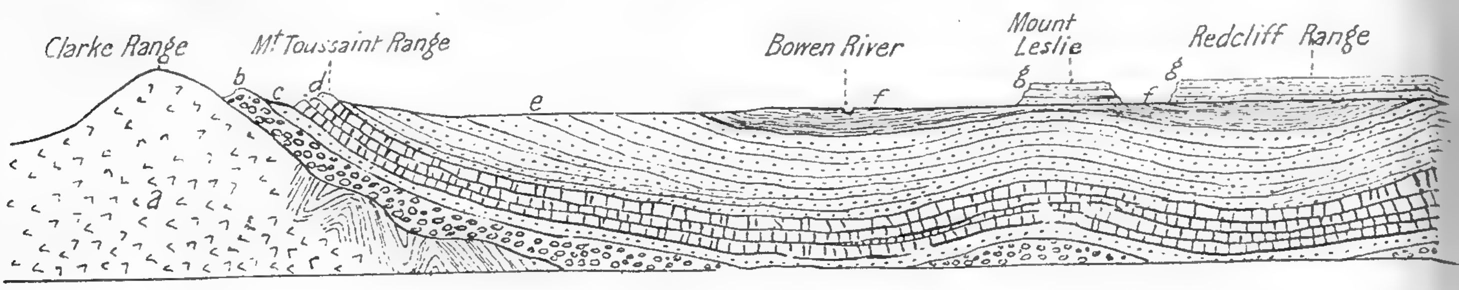


Fig. 1.—Section across the Bowen River Coalfield.

g. Sandstones unconformably overlying coalfield. Age undetermined.
f. Upper (freshwater) series of coalfield.
e. Middle (marine) series of coalfield.
d. Bedded porphyrites and basalts of Mount Toussaint and Mount Macedon Ranges.
c. Lower series of coalfield.
b. Volcanic agglomerate.
a. Plutonic and metamorphic rocks of Clarke Range.

a.—PLUTONIC AND METAMORPHIC ROCKS.

7. The coast range is composed of various plutonic and metamorphic rocks; granite, porphyry, diallage rock, diorite and actinolite-gneiss, and less-altered mica and hornblende-schists, greywackes and slates. The strike of these rocks, when recognisable, is usually N.W. and S.E., a direction corresponding to the general trend of the chain.

8. Whether these rocks are of Devonian or of Silurian age, or even older, is a question that remains for the present unsettled. I recently obtained specimens of a beautiful white marble from Mount Little (Mount Esk of the Coast Charts). If this marble should turn out to be the equivalent of that lately discovered thirty miles south of Townsville, some light may be thrown on the date of the meta morphism of the range; but further observations will be required before this point can be cleared up.

9. The auriferous districts of Normanby and Marengo occur among these metamorphic rocks. Carbonate of copper occurs at Mount Greentop, and galena is said to have been found in Flagstone Creek and the Bowen River.

10. The formations that next fall to be described have been deposited in a depression in the metamorphic rocks.

b.—VOLCANIC AGGLOMERATE.

11. About three miles below the head of Pelican Creek a little mountain rises abruptly on the western side of the bridle-path, presenting a steep escarpment to the north and a gentler slope to the south. The escarpment, which is traceable for some distance to the west and north-west, marks the line of outcrop of a bed of volcanic agglomerate, made up of angular, or but little rounded, pebbles and boulders of porphyrite and dolerite, resting on an uneven surface of granite.

c.—LOWER SERIES OF COALFIELD.

12. On descending to the bed of the creek, a mass of yellow siliceous sandstone is seen overlying the agglomerate bed. These beds show an unbroken vertical section of fifty feet in thickness, in layers of six inches to four feet, and dip to S.S.W. at an angle of 10°. Further up the creek the same dip continues, sandstone and conglomerate beds cropping out at intervals below the last section. The pebbles of the conglomerate beds are mainly of quartzite and yellow porphyry derived from the surrounding metamorphic country; but a few are of porphyrite, &c., derived from the immediately underlying bed of volcanic agglomerate.

13. Soft stratified rocks of a similar character evidently crop out all over the plain, which extends southwards from the little mountain above referred to, to Mount Divlin, under whose steep escarpment they dip and disappear. As the breadth of this flat is about a mile, a dip of 10° gives a thickness of about 880 feet. The sandstone beds exposed in Pelican Creek would form an admirable building material, being hard and durable, though easy to work. It is probable that other stratified rocks besides sandstones occur in this belt, although their outcrops are concealed by drift.

14. The Bowen and Sonoma road, between Bolger's (ruined) public-house and Strathmore Creek, crosses the outcrops of several beds of white and yellow sandstones, dipping at a low angle to the south-east. This dip would carry the sandstones beneath the porphyrites, which are first met with near Strathmore Creek, and which presently rise in terraces in the Mount Toussaint Range. From their position, resting on the metamorphic rocks and underlying the bedded traps, there can be no doubt that the sandstone beds in question are the equivalents of those which, at the head of Pelican Creek, dip under the traps of Mount Divlin.

d.—INTERBEDDED PORPHYRITES AND BASALTS.

15. The volcanic range of Mount Toussaint and Mount Divlin presents the features universally characteristic of slightly inclined trappean rocks. Such mountains appear very different according as they are viewed from the "dip" or "rise" side of the beds. In the one case the long gentle slope of the hill generally coincides with the surface of a bed. In the other the ascent must be made over a series of alternate terraces and almost perpendicular cliffs. The sketch (Fig. 2) shows in profile the features of the Mount Toussaint Range. Fig 2

Fig. 2.—Panoramic View of Mount Toussaint Range, from the South.

16. Over considerable areas, basalts and melaphyres decompose to a rich black soil, which in wet weather "balls" on the feet like snow. The amygdaloidal porphyrites form a lighter, but still very good soil.

17. The terraced and scarped hills of the Mount Macedon Range continue the outcrop of the bedded traps round the north-western corner of the coalfield.

18. The outcrop of the uppermost bed of the traps on which the lowest members of the coal-bearing series repose, forms a convenient and easily recognisable landmark, which has been taken advantage of in fixing the limits of the latter important formation.

19. In Daintree's map a belt of "basalt" is shown, enclosing the north and west sides of the Isaacs and Dawson River Coalfields, forming the Denham Range, Buckland's Table-land, and Peak Downs. In his memoir, he refers to the *southern* volcanic areas (S. of lat. 21°) as older than the "upper volcanic" rocks, and "agreeing with the lower volcanic" of Victoria, which have been ejected through fissures, and have in no case a very extensive flow beyond the lines of fracture through which they issued; and adds, "These may be referred to the miocene tertiary epoch."

20. I venture to predict that on more minute examination, the traps referred to will be found to be not only "older than the newer volcanic," but even older than the greater part of the carboniferous formation itself. Daintree's own mapping suggests as much, and the probability is rendered almost a certainty when it has been demonstrated that the volcanic rocks of the Bowen River district,* which surround the coalfield in the same way as those of Denham Range, Buckland's Table-land, and Peak Downs, clearly belong to the carboniferous period.†

21. A still more recent date than miocene is assigned to the traps of the Peak Downs, by Mr. W. Keene, late Examiner of Coalfields, New South Wales,‡ who finds "ample evidence that the outburst of the Peak Range is posterior to the deposition of the coal measures," in the fact, that at "the crossing of the Mackenzie, the igneous matter covers the coal shales containing plant remains;" and that on close examination he "found in the lava a very perfect cast of a large mussel shell, the same which now abounds in the river." I suspect that Mr. Keene did not recognise the importance of the distinction between the bedded traps of the range, and the intrusive sheets injected among the coal measure strata, and that the "large river mussel was a *Panopœa*." Mr. Keene observed the interesting fact that the coal measures have been denuded from off the top of the Downs over large districts.

22. It will be observed from Daintree's map that a trappean area in the Toowoomba district has a relation to the surrounding coalfields, similar to that subsisting between the traps of the Bowen River district and the coalfield, and to that presumably subsisting also between the traps of Denham Range, Buckland's Table-land, and Peak Downs, and the coalfield of the Isaacs and Dawson Rivers.

23. Across the New South Wales frontier, a trappean belt intervenes between the granitic mass of Point Danger and the carboniferous rocks of the Richmond River district.

24. The Tasmanian coal measures, according to Mr. R. Brough Smyth's geological sketch map, are enclosed by an almost continuous ring of trappean rocks. Mr. Inker, who visited that district in 1846, was under the impression that the traps were older than the coalfield ||

25. It is difficult to find, either in the Mount Macedon or Mount Toussaint range, a hand-specimen of the trappean rock which has not obviously undergone considerable alteration. A specimen from the south end of Mount Macedon, which appeared more than usually fresh, was sliced and examined microscopically. The ground-mass showed a tangled web of very minute interlacing crystals of labradorite, the interstices filled up with specks of magnetic iron. The augite crystals are generally represented by a zeolitic pseudomorph (prehnite?), although occasionally a nucleus of angite may be detected in the centre of an altered mass. The rock was thus, in all likelihood, originally a typical dolerite.

26. It is not surprising that igneous rocks so ancient should have undergone much alteration. On Strathmore Creek, Pelican Creek from Mount Bellavista downwards, and Bowen River from the 31st to the 41st Traverse Station (see sketch map), the rock is exceedingly amygdaloidal, and is full of cavities, sometimes of considerable size, filled up with prehnite, thomsonite, analcime, and laumonite. With the prehnite, carbonate of copper is frequently associated, some specimens of the ore being quite good enough to work if sufficient quantities could be obtained. The ore, however, has nowhere been obtained in a true lode, so far as I have been able to see or learn.

27. Mr. Saml. Allport, F.G.S., thus reports§ on the microscopic aspect of a specimen of "epidote rock" from the "Bowen River near McDougal's head station" (Biralee, now Mr. Hughes'):—

28. "It must have been originally as scoriaceous as any recent lavas, but now forms a hard solid mass of zeolitic mineral matter.

29. "All the cavities are filled with prehnite, in radiating groups of crystals, which exhibit a magnificent display of colours when examined in polarized light.

30. "One cavity is lined with the radiating prehnite, and the central portion partly filled with calcite and partly with green carbonate of copper.

31. "Of the original constituents nothing is left except the magnetite. The forms of felspar crystals are sharp and distinct; but the original substance has been removed and replaced by prehnite, differing in no respect from that filling the cavities.

32. "The reddish-brown grains and patches scattered through the base probably represent the augite."

33. In the Mount Toussaint and Mount Macedon ranges, as well as in the bed of the Bowen River and Pelican Creek, geodes of opal, agate, and calcedony are not unfrequently met with.

e.—MIDDLE

* Daintree's Map does not show the volcanic rocks of the Bowen River, the scale being too small to admit of this detail; but from references on pp. 286 and 314 of his memoir, it will be seen that he was quite aware of its existence.

† The question of the age of the coalfield will be afterwards discussed, but for convenience sake this term is used in the meantime.

‡ Quart. Journ. Geol. Soc., Lond., XXI., p. 139.

|| Notes on the Palaeozoic Formations of New South Wales and Van Dieman's Land. Quart. Journ. Geol. Soc., Lond., III., p. 241.

§ Quart. Jonrn. Geol. Soc., Lond., XXXVII., p. 315.

c.—MIDDLE (MARINE) SERIES OF THE COALFIELD.

34. The doleritic rocks have been covered by sedimentary rocks, and both have been disturbed from their original horizontality at the same time and in the same degree. The activity of the volcanic forces must have been considerably diminished, for neither lava-form nor ashy beds occur again in the history of the coalfield. But that the volcanic activity in the district in question did not cease for a long time is proved by the fact that molten rocks of the dolerite type were again and again injected along lines of weakness in the sedimentary rocks.

35. Following the right bank of the river from Biralee Station upwards, after traversing a basaltic plain for about three miles, a wall of white gritty sandstone, running N. 20 W. to S. 20 E., crosses the path. This is the lowest bed of the middle or marine series of the coal measures. Its outcrop can be easily followed down the bank into the river, where the sandstone is seen to overlie, apparently without any break, a felspathic sandstone, which in its turn rests on the surface of a bed of porphyrite. The porphyrite and sandstone beds alike dip at a low angle 20° N. of east. This is the only place where the base of the series is unequivocally visible. Elsewhere, as in Coral Creek, Pelican Creek, and on the Bowen River two miles above Beasley's (ruined) public-house, the sedimentary and igneous rocks may be observed in close juxtaposition; but there are reasons for believing them to be separated in those places by a line of dislocation, and that neither the highest members of the one series nor the lowest of the other are seen at the points of junction.

36. Up to a point midway between the mouths of Rosella and Parrot Creeks, the marine series occupies the bed of the Bowen River. After plotting the observed dips of the strata, I estimate their total thickness at 1,848 feet. The area occupied by the marine series, as will be observed from the map, is much greater at the north-west end of the field than on the eastern side; the strata in the latter region having a comparatively high dip.

37. The marine series is made up of alternations of grey and yellow sandstones and blue and grey shales, with here and there bands of reddish ferruginous, probably once calcareous sandstones, sometimes varying to sandy, impure ironstones. Two seams of coal (besides some carbonaceous beds, hardly deserving the name) occur in this series, which I have named the "Garrick" and the "Kennedy." Near the top of the series, black shales, highly impregnated with alum, are abundant.

38. The bands of ferruginous sandstone are storehouses of marine fossils, which occur also, though more sparingly, in the shale and grey sandstone beds. In the grey sandstones the shells are almost always calcareous, and contrast strongly with the siliceous and felspathic sandstone matrix. In the ferruginous sandstones, on the other hand, the fossils are always casts. The shales and grey sandstones are frequently pierced by rootlets, in the position of growth.

39. A few beds of conglomerate are met with, chiefly in the lower part of the series. The included pebbles are generally of granite, slate, schist, quartzite, and other metamorphic rocks, with a few of porphyrite. The pebbles, which are not always well rounded, have a remarkable tendency to arrange themselves in groups in some of the conglomeratic sandstone beds—a disposition which may possibly be owing to their having been dropped in heaps from the floating roots of trees, but much more likely from floating ground-ice. Large isolated boulders of granite, &c., occur here and there in the midst of strata of fine sandy or muddy material. These could hardly have been brought to their present positions except by glacial action. Portions of the trunks of coniferous trees are occasionally found, lying horizontally in the strata.

40. The marine shells throughout the series prove that the strata were mainly deposited by a sea, of which the Clarke Range formed the eastern shore; while the upright rootlets in the grey sandstones and shales indicate the occasional appearance of land-surfaces.

41. The following are details of the sections observed in the marine series. The streams, unfortunately, do not give continuous sections, and hence frequent gaps occur. The sections are, however, *complete*, so far as is at present visible, and are now put on record, partly to facilitate comparison with other districts, and partly to obviate the necessity of doing the same work over again. Those who "want to know what is below the surface" may be reminded that a continuous section of strata observed at their outcrop is exactly the same thing as a vertical bore.

COCKATOO CREEK.

42. *One mile S. of Bowen River.*—Grey shales. Top of marine series. Dip at 20° up stream, S.E. [No section in the creek for half-a-mile below this. A possible thickness of 920 feet of strata concealed. A lump of *coal* in bed of creek.]

43. *Half-a-mile down creek from last section.*—Dip at 25° to E. 20 S.:—

	ft.	ins.
Pebbly sandstone, with ferruginous concretionary parts, containing shells and *Fenestella*	1	6
Gap—room for	20	0
Grey shale or soft shaley sandstone	15	0
Sheet of porphyry (intrusive)	10	0
[This, as well as similar sheets throughout the coalfield, may be suspected to occupy the place of a coal seam.]		
Shaley grey sandstone, full of shells, especially *Productus Clarkei*, Eth. ...	3	0
Soft grey shales, with shells and *Fenestella*	5	6
Soft grey sandstone	0	9
Grey shales, the lowest 20 feet, full of *Productus Clarkei*	40	0
Total in almost continuous section	95	9

[A short gap between this and the next section.]

44. *Half-a-mile*

44. *Half-a-mile above junction of creek with Parrot Creek* :—

	ft.	in.
Grey sandstone with pebbles and *Productus Clarkei*	4	0
Soft grey sandstone	12	0
Sheet of porphyry (intrusive)	20	0
Sandstone, full of *Productus Clarkei*	8	0
Total in continuous section	44	0

BOWEN RIVER.

[A considerable gap intervenes between the last section in Cockatoo Creek and the uppermost strata of the marine series seen in the river.]

45. *On the No. 25 Traverse Station Gully, below the Biralee and Havilah Road.*—Dip at 5° to E. 20 N. Numerous lumps of fair *coal* in river bed below mouth of this gully. No outcrop visible. Shales and sandstones, the sandstones containing *Panopæa*, 30 feet.

46. *At mouth of gully at the No. 25 Traverse Station.*—Horizontal. Cut by a 3 feet dyke of dolerite running E. 20 N. :—

	ft.	in.
Grey sandstone	1	0
Shales	2	0
Total	3	0

47. *Quarter of a mile below No. 25 Traverse Station.* Dip S.E. at 5° :—

	ft.	in.
Grey sandstones, shales, and lines of *ironstone* nodules	25	0
Gap—room for	3	0
Soft grey sandstone, with pebbles, and *Pecten asiaticus*, de Koninck	4	0
Shales, with nodules of *ironstone* containing *Pecten asiaticus* and boulders of granite	35	0
Conglomerate (pebbles and boulders of granite and various metamorphic rocks) ... ... 1 foot to	3	0
Grey sandstone, with rootlets	3	6
Do. do. , the upper part with "nests" of pebbles and shells	6	0
Shales, with rootlets	2	10
Line of impure sandy *ironstone* and pebbles	0	4
Dark-blue shales	2	6
Soft grey sandstone	0	8
Dark-blue shales	1	6
Concretionary ferruginous sandstone, with fossils	1	0
Grey sandstone, with rootlets	1	8
Shales, with concretionary ferruginous sandstone bands	3	0
Fossiliferous conglomerate (*Pecten asiaticus*)	0	10
Grey sandstone	0	8
Shales	0	5
Impure nodular *ironstone* ... ... 2 in. to	0	4
[Here the gully between No. 25 and No. 26 Traverse Stations falls into river.]		
Grey shales, with large balls of impure *ironstone*	6	0
Soft grey sandstone, with rootlets	0	10
Grey shales	8	0
Soft grey sandstone, with rootlets	0	6
Grey shales	1	6
Soft grey sandstone	0	5
Grey shales	10	6
Concretionary ferruginous sandstone, with "nests" of pebbles and boulders, —(one granite boulder contains 1 cubic yard)—fossil shells, and silicified wood	2	0
Grey shales, with *ironstone* nodules	3	0
Grey sandstone, with rootlets	1	0
Shales	0	11
Grey soft sandstone, with rootlets	4	0
„ shales	5	0
„ sandstone	1	0
„ sandy shales	4	0
„ soft sandstone	0	10
„ shales	1	0
„ soft sandstone, full of *Productus Clarkei*. (The base of the bed, which forms a waterfall, is not seen)	5	0
Total in almost continuous section	150	9

48. *A deep gully falls into the river (r. bank)* below the waterfall, and shows a section of grey shales, also full of *Productus Clarkei*, underlying the sandstone, but not immediately. A thickness of about 12 feet of similar shales (probably the same), full of *Productus Clarkei*, is seen below on the bank of the river.

For

For the next half-mile, i.e., to about the 26th Traverse Station, sections of sandstone and shales, with *Productus Clarkei*, &c., are seen at intervals. They dip up-stream (E. 20 S.) at 5°. The strata of this part of the river are probably represented by those observed in *Stonehumpy Creek*, in a horizontal section, beginning at the E. and W. bend of the creek, above the road, as follows :—

	ft.	in.
Shaley sandstone ...	10	0
Conglomerate ...	1	6
Grey sandstone ...	0	8
Shales ...	0	6
Conglomerate or pebbly sandstone (pebbles and boulders of granite, yellow porphyry, porphyrite, and quartzite) ...	2	0
Shales ...	1	1
Pebbly sandstone, with "nests" of pebbles and some large angular granite blocks (forms a waterfall) ...	4	0
Shales ...	0	6
Pebbly sandstone ...	0	10
" shales ...	9	0
" sandstone ...	3	0
[Road crossing here.]		
Shales ...	1	2
Pebbly sandstone ...	0	9
Shales with large isolated granite blocks ...	2	0
Pebbly sandstone, with *Productus Clarkei*, in parts almost a mass of *Productus* spines ...	0	8
Shales ...	2	6
Ferruginous pebbly sandstone or conglomerate ...	0	11
Grey shales ...	3	0
Pebbly sandstone ...	1	0
" grey shales ...	6	6
Every bed in the above section is crowded with fossil shells, especially *Productus Clarkei*. Bedding horizontal.		
[At this point a fault is seen, with a downthrow of 4 feet to W. 20 N.]		
Coarse ferruginous conglomerate, full of a large *Pecten* (*P. asiaticus?*) ...	2	0
Shales ...	0	6
Grey sandstone, with shaley partings ...	18	0
[Slight dip up-stream.]		
Shales ...	12	0
Grey sandstone, with rootlets, and tending to weather spheroidally ...	3	6
Shales ...	3	0
Gap—room for about ...	5	0
Ferruginous sandstone ...	0	8
Shales ...	2	0
Ferruginous sandstone ...	0	4
Sandy shales ...	12	0
Grey sandstone ...	0	5
" sandy shales ...	4	0
Ferruginous sandstone, with pebbles and shells ...	0	9
Grey shales with rootlets ...	3	8
Ferruginous concretionary sandstone, with pebbles and large *Pectens* ...	0	8
Grey shales ...	8	0
Ferruginous sandstone, with shells ...	0	6
Grey sandy shale, with large isolated granite blocks ...	18	0
Grey sandstone, with large *Pectens* ...	1	6
" sandy shales ...	16	0
" soft sandstone ...	4	0
" shales ...	2	8
" soft sandstone ...	2	0
" shales ...	4	0
Gap—room for ...	10	0
Sandy shales, with bands of ferruginous sandstone ...	15	0
Total, in almost continuous section ...	201	9

[Mouth of creek here.]

50. *About quarter of a mile below Stonehumpy Creek*, a 10-ft. bed of sandstone is seen, dipping E. 10 N. at 5°

51. *About a furlong lower*, another sandstone bar crosses the river, with same dip; *quarter of a mile lower*, a third bar, with same dip.

52. *At the 29th Traverse Station bend*, on the left bank of the river, is a section of about 30-feet of sandstones and shales.

53. *Two hundred yards below this*, horizontal sandstone is seen in the bed of the river.

54. *Between No. 29 and No. 30, Traverse Stations*, a horizontal bed of conglomerate forms rapids in the river. The pebbles (which are well rounded) are mostly of granite, with a few of porphyrite. The conglomerate rests on a thick bed of sandstone (dipping slightly up-stream south), over which there are extensive rapids.

55. *At*

55. *At the No.* 31 *Traverse Station Bend* the basal bed of the series, already referred to, is met with—a white gritty siliceous sandstone about 30 feet thick. It dips to E. 20 N at a low angle, and overlies (conformably) felspathic sandstone and porphyrite—the uppermost beds of the volcanic series.

56. We have thus, in the Bowen River and its tributary streams falling in between Cockatoo Creek and Stonehumpy Creek, visible sections of about 580 feet of the estimated thickness (1,848 feet) of the marine series.

57. *The gully falling into the river between the 25th and 26th Traverse Stations* gives the following section (dip east, at 7°) of strata, probably identical with those seen in the river below the mouth of the gully:—

		ft.	*in.*
Grey sandstone, with "nests" of pebbles and shells ...		3	0
Flaggy soft grey sandstone ...		2	6
Grey sandstone, with "nests" of pebbles and shells ...		5	0
Soft flaggy and shaley sandstones, with upright rootlets and pebbles ...		6	0
[These beds form a waterfall above the road.]			
Ferruginous sandstone band with pebbles and shells ...		0	8
Soft grey sandy shales ...		8	0
Band of pebbles and shells ...	2 in. to	0	9
Grey shales ...		4	0
Soft grey sandstone pierced by upright rootlets ...	waterfall	3	7
Shaley sandstone ...		4	0
Grey sandstone, more compact ...		1	10
Grey shales (mouth of creek) ...		2	0
Total in continuous section...		41	4

58. Up the river, from below the mouth of Rosella Creek, beds belonging to the upper or fresh-water series are met with for eleven miles. It is not till about *two miles above the old crossing at Beasley's* that the marine series emerges from beneath the fresh-water series.

59. For about a quarter of a mile of the river's course the right bank shows grey sandstone beds dipping to S.W. at about 50°. A thickness of at least 100 feet of these sandstones is packed full of *Productus Clarkei*. Half-a-mile higher, on the left bank, a sandstone cliff known as "*the Wall*," running N.W. and S.E. for some miles, is the escarpment of a bed dipping at 35° to S.W. This bed is the last of the coal measures seen in this direction, metamorphic rocks occupying the banks of the river higher up. The high angle is probably due to the proximity of a fault dividing the coal measures from the more ancient rocks.

60. Beds belonging to the freshwater series are seen about a mile above Beasley's old crossing, and it is probable that the *productus* sandstones above referred to are near the top of the marine series.

CORAL CREEK.

61. *About half-a-mile above the crossing of the bridle-path from Sonoma to Mount Pleasant* the following section is seen in Coral Creek, with a dip of 7 to 10° to the east:—

	ft.	*in.*
Blue shales, with a 10-inch bed of impure *ironstone* ...	12	0
Gap—room for ...	20	0
Soft grey sandstone ...	4	0
Dark carbonaceous shale (not laminated), with calcareous divisions ...	1	8
White shales, with calcareous layers ...		?
Grey and yellow sandstone, with ironstone bands ...	4	0
Gap—room for ...	20	0
Yellow sandstone ...	1	2
Grey shales ...	5	0
„ sandstone ...	1	10
„ sandy shales, with a lenticular *ironstone* band ...	15	0
Impure ironstone with nodular weathering ...	0	2
Soft grey sandy flags or shales, with calcareous bands on top ...	5	0
Grey sandy shale ...	4	0
Clayey white sandstone ...	2	0
Soft white sandstone ...	5	0
Total in almost continuous section ...	100	10

62. 200 *yards lower*, with the same dip. Grey and yellow shales and thin white sandstones 20 feet.

63. *About* 300 *yards above the outer paddock fence of Sonoma*, a bed of grey sandstone is seen.

64. *Midway between the bridle-path crossing and the last-mentioned fence*, the surface of a bed of grey sandstone is seen in the creek.

65. *At the bend immediately above the crossing*, 15 feet of grey and yellow shales and sandstones dip to the east at 5°.

66. The

66. The creek gives no further section till *about 50 yards above the lowest fence*, where the following strata appear, with a slight dip to N. 20 E.:—

	ft.	ins.
Grey shales ...	10	0
Gap—room for ...	20	0
Fine-grained sandstone, weathering red ...	2	6
Grey shales (base concealed.)		

67. *Just below the fence*, horizontal grey shales are seen in the bed of the creek.

68. *At lower end of waterhole below main road*, the upper beds nearly horizontal; the lower rising from beneath them, with a dip of 5° to E. 20 S.:—

	ft.	ins.
Buff-coloured sandy shales ...	10	0
Soft fine-grained grey sandstone ...	1	0
Buff sandy shales ...	1	8
Soft fine-grained grey sandstone ...	1	10
„ grey shales ...	8	0
„ sandstone ...	0	3
„ shales, with a few pebbles of quartzite and greywacke, and large unrounded blocks of granite (up to 3 cubic feet) ...	5	0
Nodular ferruginous sandstone, with a few pebbles and corals in position of growth, and *Panopæa* ...	1	0
Grey and yellow shales, with a few pebbles (quartzite, greywacke, and granite)	6	0
Dark sandy shales, with very indistinct plant remains ...	1	0
Nodular ferruginous conglomeratic sandstone ...	0	6
Conglomerate, with shaley matrix...	2	0
Total in continuous section ...	38	3

69. No more rock is seen for 300 *yards down the stream*, when some shales occur, with indistinct plant remains (rootlets?) Dip E. 20 S. at 5°.

70. *A little lower*, a cliff on the left bank exposes the following. Dip E. 20 S.:—

	ft.	ins.
Yellow sandstone ...	3	0
Shales, with plant remains ...	0	6
White sandstone, with rootlets (forms little waterfall)...	3	0
Dark-grey shales ...	2	2
Reddish hardened sandstone, with corals and *Streptorhynchus* ...	0	4
Dark-grey soft sandstone, or sandy shale, with rootlets and isolated granite blocks ...	5	0
Total in continuous section ...	17	11

71. *At the mouth of the creek* a band of hardened reddish sandstone with shells overlies 3 feet of grey shales. These strata dip to S.W. at 4°.

72. The several sections on Coral Creek given above would appear, from the direction of the observed dips, to follow one another in regular descending order, although with numerous gaps.

73. Higher up the creek than the section given in par. 61 the dip is reversed, and the strata rise at an angle of 15° to the north-east. The following sections, therefore, probably repeat the preceding, in part—the same beds cropping out on the opposite side of a synclinal trough.

74. *Almost immediately N.E. of the section in par.* 61. Dip S.W. at 15°:—

	ft.	in.
Soft grey shales, with calcareous partings ...	4	0
Coaly clay ...	0	1
Dark shales ...	0	5
Coaly clay ...	0	2
Bluish shales ...	2	6
Sandstone (top only visible).		
	7	2

75. *Fifty yards higher up the creek.* Dip S.W., at 15°:—

	ft.	in.
Dark carbonaceous shales, with calcareous partings ...	12	0
Sandstone ...	2	0
	14	0

76. For the next quarter of a mile no rock is exposed to view. The "drift" becomes very red, as if from the decomposition of ferruginous rocks. *At the end of a quarter of a mile* decomposed porphyrite is seen—apparently a bedded mass.

77. *About* 300 *yards above this* are 20 feet of yellow shales and sandstones, dipping at 15° to S.W.

78. *A little higher* is a confused tumbled exposure of yellow sandstone, shales, ironstones, and coaly clay. These are the last of the stratified rocks exposed by the creek. In another quarter of a mile the bed is found to be occupied by porphyrite. In all probability the stratified and igneous rocks are here divided by a fault, as between the place where the dip is reversed and the place where the porphyrite is first seen there is not room for the outcrop of the whole of the series, as seen from the former point down to the mouth of the creek. The jumbled condition of the stratified rocks seen nearest to the porphyrites appears also to indicate a line of dislocation.

PELICAN CREEK.

79. *For nearly a mile down the creek, from a point north of Sonoma, near the old sheep station,* horizontal shales and grey sandstones occur at intervals. *At the end of a mile* the strata begin to dip slightly up stream (N.E.), and 20 feet of grey shales are seen.

80. *Half-a-mile further down* (dipping east at 5°), alternate bands of shale and grey sandstone; the sandstone full of rootlet impressions, and with a tendency to spheroidal weathering, 30 ft.

81. *A quarter of a mile lower.* Dip 5° to N.E. (The section extends down the stream for about half-a-mile) :—

	ft.	ins.
Decomposing yellow calcareous sandstone, full of shells, chiefly *Producti* ...	0	10
Shales	1	0
Soft grey sandstone	1	6
Shales, with a few pebbles...	2	8
Grey thin-bedded standstone, with upright rootlets	3	4
Grey shales...	4	0
Soft sandstone full of rootlets	0	11
Grey shales, with occasional large granite boulders (up to 4 cubic feet) ...	2	0
Hard ferruginous sandstone, with impressions of very large *Pectens*	0	8
Grey shales, with rootlets	1	0
Hard ferruginous sandstone, with shells, &c.	1	0
Soft grey sandstone, with upright rootlets, and occasional partings of shale...	8	0
Pebbly shale, with a tendency to spheroidal weathering	5	0
Fine grey sandstone, with lumpy ferruginous top, groups of pebbles (granite, greywacke, and quartzite), and of fossils (among others a large *Edmondia*, large *Streptorhynchus*, and silicified coniferous wood) ... 8 in. to	6	0
Grey sandy shale, with isolated granite boulders	3	0
Soft grey sandstone, with groups of pebbles and boulders, and also concretionary ferruginous parts, containing *Panopæa*, *Edmondia*, &c. [Specimens marked ½-mile above Sonoma road crossing]...	4	0
Gap—room for	50	0
Half-mile above crossing of main Bowen and Sonoma Road (dip E. at 5°) :—		
Yellow hardened sandstone, with large *Panopæa*, *Productus*, *Cora*, *corals*, *&c.*	0	8
Grey shales	15	0
Impure nodular limestone, with pebbles and large unrounded blocks of granite, corals, &c.	0	3
Soft grey sandstone, with rootlets ... ... 9 in to	2	0
Grey shales	8	0
Total	120	10

82. These rocks are intersected by a 3-ft. dolerite dyke running east and west, and hardening the shales and sandstone in its immediate neighbourhood. A sketch of this dyke is given in Mr. Daintree's Memoir (see Quart. Journ. Geol. Soc., Lond., XXVIII., p. 312).

83. *On right bank,* 50 *yards below section in par.* 81, *and for* 100 *yards down.*—Slight dip to east; thin-bedded grey sandstones and shales (thickness unknown).

84. *On right bank,* 50 *yards lower.*—Reddish ferruginous hardened pebbly sandstone, with *Panopæa*, &c., 1 ft.; grey sandy shale, 2 ft.

85. *One hundred yards above crossing of Bowen and Sonoma road.*—Dip E. 20 N. at 4°. Soft grey sandstone, with rootlets, 1 ft.

86. *Three hundred yards above mouth of Coral Creek.*—Dip E. 20 N. at 4°. Soft grey sandstone, 3 ft.

87. *Half-a-mile below mouth of Coral Creek, on left bank.*—Dip to E. 20 S. at 3°. Shales, with a 1-ft. bed of ferruginous pebbly sandstone, containing fossils (the gigantic *Edmondia*, and the characteristic corals of Coral Creek).

88. *One hundred yards below last section.*—Dip E. 10 S. at 5.° 3 ft. of grey sandstone, with rootlets; the top ferruginous and containing large shells. For the next 200 yards the same dip continues, with alternate shales and rootlet-marked sandstones.

89. *One mile below Coral Creek.*—Same dip; 6 ft. of grey shales on 1 ft. of rootlet-marked sandstone.

90. *At mouth of gully, above Palmer's Old Station* (100 yards below last section).—A 4-ft. bed of grey rootlet-marked sandstone (horizontal).

91. *Opposite*

91. *Opposite Palmer's Old Station.*—Dip E. at 3°. Grey shales and shaley sandstone, with *Panopæa*, 4 ft.

92. *Two hundred yards below Old Station.*—Dip W. 20 S. at 5°. (From the inversion of the dip it is probable that the strata in this section have their place between those in the two preceding sections):—

	ft.	in.
Blue and reddish shales	15	0
Grey shales, full of *Productus Clarkei*	10	0
„ sandstone	4	0
Shales	1	6
Grey sandstone	1	10
Shales	3	6
Soft sandy shales, full of *Productus Clarkei*	7	0
Soft sandstone, full of *Productus Clarkei*	5	0
Soft grey sandy shales	2	0
Ripple-marked sandstone, in two beds	4	0
Soft grey rootlet-marked sandstone	5	0
Total, in continuous section	58	10

93. *Mouth of Two-mile Creek.*—Slight dip to east. Grey sandstone, forming a waterfall in Pelican Creek, 6 ft.

94. *One mile below mouth of Two-mile Creek.*—Grey sandstone full of *Productus Clarkei*, 1 foot, 6 inches.

95. *Bend at No. 2 Traverse Station.*—Dip E. 20 N. at 5°. Yellowish shales, 8 feet.

96. *No. 4 Traverse Station (right bank).* Dip N.E. at 5°:—

	ft.	in.
Impure *ironstone*, with shells	0	6
Grey and buff sandstone (good building stone), with a few partings of shale	20	0
Total...	20	6

97. *At boundary of Sanddowns and Fan Fan Blocks.* Dip E. at 5°:—

Soft white flaggy sandstones and shaley partings	27	0
Talus, concealing about	15	0
Dark-blue shales	5	0
Soft grey sandstone	0	9
Gritty white siliceous sandstone	2	8
Dark-blue shales	0	7
Coal	0	3
Dark-blue shales	0	1
Coal—KENNEDY SEAM	1	6
White fine-grained soft clayey sandstone, with upright rootlets	5	0
Soft yellow sandstone	2	0
Sandy shale	3	0
Soft yellowish sandstone	2	0
Shales, with a line of large ironstone nodules	8	0
Good white sandstone, in bands of about 8 inches thick	6	0
Shales	1	0
Yellowish sandstone	5	0
Total in almost continuous section	84	10

98. *Half-a-mile further down stream.* Dip N. at 7°. Believed to underlie the last section:—

	ft.	in.
Thick-bedded yellow sandstone, with *Edmondia* and *Panopæa*...	10	0
Soft flaggy and shaley grey sandstone	20	0
Impure sandy *ironstone*, weathered ... ... 0 to	0	9
Soft grey laminated fine-grained shale, weathering yellowish	6	0
Coal—GARRICK SEAM	4	7
Soft grey shaley sandstone, with (sparse) rootlets	5	0
Total in almost continuous section	46	4

99. Figures 3 and 4 represent the outcrops of the Kennedy and Garrick seams.

100. High up on the bank, between the outcrops of the Garrick and Kennedy seams, a third coal seam is seen, capped by a bed of sandstone. Although there is no intelligible section at the place, there is reason to believe that the geological horizon of this seam is beneath that of the Garrick.

FIGS. 3 AND 4.

Fig 3.—Outcrop of the Kennedy Coal Seam, Pelican Creek.

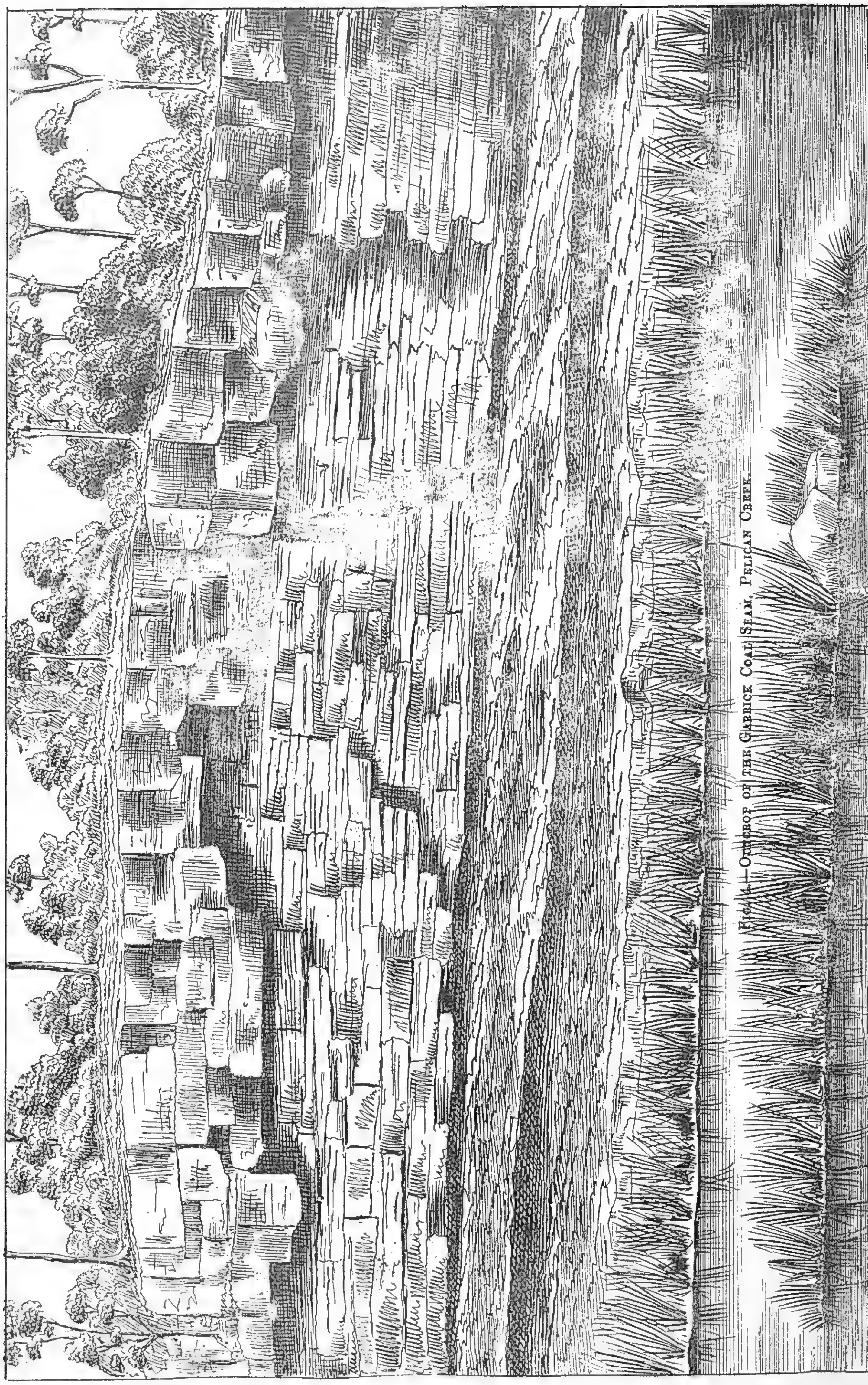


Fig. 4.—Outcrop of the Garrick Coal Seam, Pelican Creek.

101 *Near No. 6 Traverse Station.* Slight dip to S.E

	ft.	ins.
Good white sandstone in two beds ...	6	0
Grey shales ...	1	8
Sandstone ...	0	3
Grey shales ...	0	10
White sandstone ...	5	0
Sandy shales ...	1	8
Grey sandstone ...	3	0
Sandy shales ...	2	6
White sandstone ... 3 or	4	0
Total in continuous section ...	24	11

102. *Quarter of a mile below No. 6, Traverse Station (left bank)*, white gritty sandstones and shales—horizontal (thickness unknown).

103. *Bend at No. 7, Traverse Station (right bank).* (Violent dip to S. at east end of section Slight dip in same direction at west end, horizontal in middle):—

	ft.	ins.
White sandstone, weathering yellow ...	20	0
Grey shales and flags ...	3	6
Blue-black shales* ...	0	10
Brown shales* ...	0	6
Blue-black shales* ...	0	8
Grey shales* ...	0	2
Dark carbonaceous shales* ...	0	4
Blue-grey shales* ...	1	2
Black shales* ...	0	3
Dark-blue shales* ...	0	4
Coaly shale* ...	0	6
Blue-grey shales ...	0	10
Dark shales ...	0	2
Dark-blue shales ...	8	6
Sandy *ironstone* ... 1 in. to	0	9
Yellow shaley beds; in part sandstone ...	20	0
„ sandstone ...	10	0
Light-blue shales, with a band of *ironstone* nodules up to 9 inches thick. (This ironstone, though not of workable quality, is the best seen in the *marine* series) ...	8	0
Sandstone ...	0	3
Dark shale, with coaly streaks ...	6	0
Grey shales ...	1	0
White sandstone ...	5	8
Total in continuous section ...	89	5

104. Referring to this section, Mr. Daintree observes:—" Directly upon this (the 'coal seam') rests a coarse-grained sandstone with a few imperfect casts of shells; while at the top of the cliff an arenaceous limestone band holds abundant specimens of the *Streptorhynchus crenistria*, so common throughout all the lower marine series.

105. " No plant remains could be detected in the section, but the dip is very slight down the creek; and in the next cliff, on the downward course of the stream, we have a section of the measures of nearly the same dimensions, with shale and sandstone interstratified, in which very perfect impressions of *Glossopteris* were found."

106. It is a remarkable instance of the changes produced in a few years in the physical features of the land by a large river, that nothing whatever is now visible of the section from which Mr. Daintree obtained *Glossopteris*. The cliff must have tumbled down, and the *débris* must have been covered over by soil and vegetation.

107. From Mr. Daintree's observations it may be gathered that the beds containing *Glossopteris* were higher in position than the section in par. 103.

108. *About half-a-mile below the section in par.* 103, sandstones, flags, and conglomerates are seen dipping east.

109. Probably a north-and-south fault (downthrow east) crosses the river shortly below the section in par. 108, where a thick bed of felspathic sandstone and conglomerate—apparently about the top of the volcanic series—dips at 10° to the south-west, and overlies a bed of porphyrite.

110. Down Pelican Creek, from the old station north of Sonoma, it will be observed that rock-sections are only seen at long intervals; but as the dip is for the most part up-stream (east), it may be assumed, almost with certainty, that the strata are encountered in descending order. The foregoing sections represent what might be seen by the reader if he were to descend a shaft something like half-a-mile in depth, sunk at the old station, if the greater part of the shaft were boarded up.

111. Opposite the old station, the dip of the strata with which the Pelican Creek sections begin is reversed—at first, at a very low angle (3°). We have, therefore, in ascending the stream from this point, a descending section, which may either, so far as it goes, be a repetition of the section traversed in descending the stream from the same point, or must fill up some of the gaps in that section.

FIG. 5.

* The "Coal Seam," of which a sketch is given in Mr. Daintree's Memoir (Quart. Journ. Geol. Soc., Lond. XXVIII., p. 287). The carbonaceous shale is, however, too poor to be entitled to the name of coal, except in a geological sense. These beds have a curious contortion, which is not shared by the overlying sandstone.—See Sketch. fig. 5.

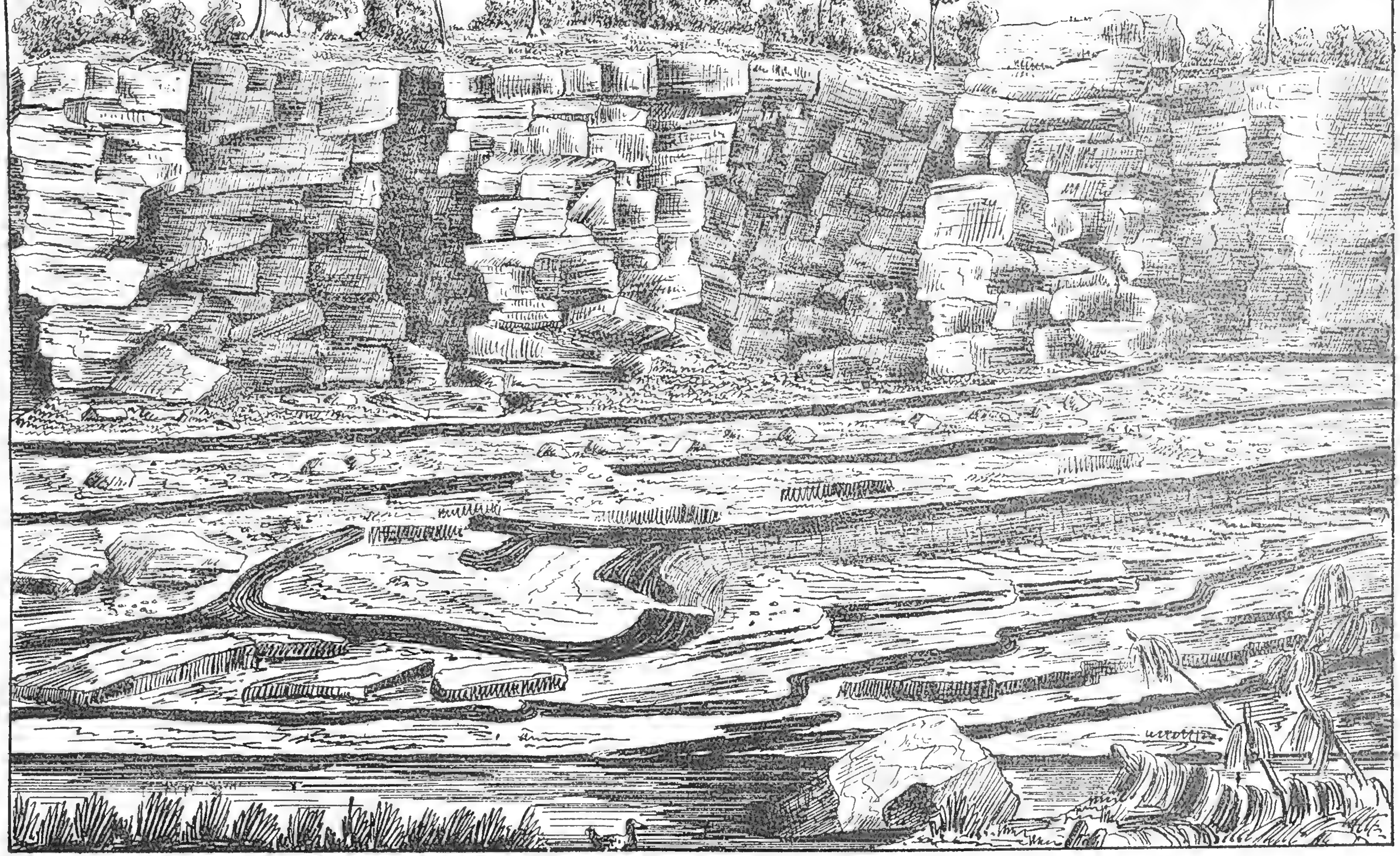


Fig. 5.—Contortion in Carbonaceous Shales, beneath undisturbed Sandstone. No. 7 Traverse Station, Pelican Creek.

112. *About half-a-mile up-stream from the old station* the creek branches, lumpy grey sandstone (dip uncertain) being seen at the junction.

113. The eastern branch gives no further section of the stratified rocks. In about a mile and a-half, the bedded traps occupy the banks of this branch.

114. *In the main (western) branch, a few yards above the junction*, a thickness of about 60 feet of grey sandstone, in beds, with shale partings, is seen dipping to E. 20 N., at an angle of 20°.

115. *Three-quarters of a mile higher, on right bank.*—Dip E. 20 S. at 15°. Grey pebbly sandstones (with *Producti*) and shales, 20 feet.

116. *A quarter of a mile higher, on left bank.*—Dip 15° to S.W. Fine-grained grey calcareous sandstone, say 20 feet thick, crammed throughout, like an oyster-bed, with shells of *Productus Clarkei* [specimens marked "5 miles north of Sonoma"].

117. This is the lowest bed of the marine series seen in this direction. A quarter of a mile higher the traps are seen on the right bank of the creek, and continue to the northern escarpment of Mount Divlin.

BIN-BIN CREEK.

118. This creek gives a not very intelligible section, owing to frequent inversions of dip, and long intervals between the exposures of rock.

119. *Quarter of a mile up from mouth.* Slight dip to E 20° N.:—

	ft.	in.
Conglomerate ...	20	0
Dark-blue shales ...	3	0
White sandstone ...	3	6
Dark-blue shales ...	6	0
Sandstone and white shale layers ...	8	0
Gap—room for ...	10	0
Conglomerate in bed of creek (Same bed seen in Bowen River near mouth of the creek), at least ...	10	0
Total in almost continuous section ...	60	6

120. *One furlong higher up the stream.* Dip S.E. at 10°:—

Pebbly sandstone ...	1	0
Conglomerate ...	2	0
Dirty-green shale ...	0	9
Conglomerate ...	5	0
Brownish-black shales ...	3	0
Dark-blue shales ...	3	8
Grey shales ...	4	6
Sheet of intrusive dolerite ...	12	0
Total in continuous section ...	31	11

121. *Quarter of a mile higher up.*—Dip N. 20° E. at 5°. Conglomerate, 10 feet at least, on white sandstone.

122. *Three furlongs higher up.*—Dip N.E. White sandstone, 16 feet thick, on conglomerate.

123. *About half-a-mile higher* the creek bifurcates. Dolerite and porphyrite beds occupy the bed of the creek for about a quarter of a mile below the junction. The porphyrite is amygdaloidal, with cavities filled with zeolites; and numerous little veins of calcite and quartz.

PARROT CREEK.

124. The strata exposed in this creek undulate considerably. From this circumstance, and from the large blanks which occur in the section, the connection of the strata is frequently lost, and it is often impossible to say whether they are being traversed in ascending or in descending order. The whole of the strata seen in this creek must, however, be near the top of the marine series.

125. *Half-a-mile up the creek, above mouth of Cockatoo Creek*, on the right bank, is a large bluff with 20 or 30 feet of alluvial drift, composed of large and small rounded blocks and pebbles, consolidated in part to sandstone and conglomerate; resting on about 15 feet of violet-brown shales and soft sandstone, with a few pebbles. The shale and sandstone dip to W.S.W. at 10°, but begin to rise in the opposite direction at the south end of the cliff.

126. *Immediately above the mouth of Cockatoo Creek.*—8 feet of grey shales, with a 2-inch line of ferruginous sandstone; dip at 7° to S.W., and, therefore, probably underlie the strata noted in par. 125.

127. *One mile above the mouth of Cockatoo Creek.*—Horizontal, but probably underlying the strata noted in par. 125. Grey sandy shales, with bands of concretionary ferruginous sandstone and pebbles, 20 feet. The sandstone contains corals identical with those found in Coral Creek, below Sonoma.

128. *Quarter of a mile higher up (left bank.)*—Dip S. 10 E. at 5°. Grey shales and grey sandstone, 20 ft.; the shales dark in places, with carbonaceous markings.

129. *Less than a quarter of a mile higher (right bank.)* Slight dip to S. :—

	ft.	in.
Pure white, fine-grained, hard, silicious sandstone (a very good building stone), in beds about 6 inches thick; top and bottom yellow, ferruginous...	20	0
Gap—room for	10	0
Sandstone, partly ferruginous, with casts of shells	2	0
Soft, shaley, grey sandstone	15	0
Total	47	0

130. These beds apparently overlie the section in par. 128. The creek, immediately after, makes a bend to the westward for a short distance, and the beds in the above section rise again to the surface. Ten feet of dark grey shales are seen below the white sandstone, thus filling up the gap in the section par. 129.

131. *Quarter of a mile higher* (course of creek S.S.W.) Horizontal:—

	ft.	in.
Light-grey shales	12	0
Bluish-black shales...	8	0
Total	20	0

132. *Quarter of a mile higher.* Dip S. at 8°. Probably overlying last section:—
Grey shales 20 0

133. *For the next quarter of a mile up-stream* the right bank is occupied by about 30 feet of thin-bedded white and yellow sandstone, and white and yellow shales—horizontal; but from the rise of the ground evidently overlying the section in last paragraph.

134. *At the upper end of the preceding section* the strata rise to the south; and below the beds noted in par. 133 there appear about 12 feet of dark bluish-grey shales, impregnated with *alum.*

135. *For the next quarter of a mile* (deep, wide waterhole; course S. 20 E.) the right bank shows 30 feet of horizontally-bedded grey flaggy sandstones, capped by a 2-foot bed of compact white sandstone. At the upper end of the waterhole the left bank shows about 8 feet of grey shales below the white sandstone. Here the strata begin to dip down-stream. They probably underlie those noted in par. 134.

136. 100 *yards higher* a dyke of dolerite, 12 feet wide, crosses the creek. The stratified rocks are not seen in contact with the dyke.

137. *For the next mile* (course of creek S.S.E.) no rock is seen, the sloping grassy banks probably concealing shales and other soft stratified rocks. At the end of this distance the creek is crossed by an intrusive sheet of white porphyry. It "dips" north at 25°, and is seen, in a gully which falls into the left bank of the creek, resting on bluish-grey shales, in which it produces no alteration.

138. 200 *yards higher,* bluish-grey shales are seen, dipping north at 10°. They overlie 30 feet of grey and dark shales, with a 30-inch bed of tough felspathic grey-brown sandstone.

139. 200 *yards higher, on right bank :—*

	ft.	in.
Thick-bedded yellow gritty sandstone	12	0
Soft yellow thin-bedded sandstone	6	0
Gap—room for	8	0
Shales	2	0
Gap—room for	10	0
White siliceous sandstone, containing siliceous shells	2	0
Total	40	0

These strata apparently underlie the bed of felspathic sandstone mentioned in par. 138, large blocks of which have tumbled down the bank.

140. The creek here runs between two little ranges of intrusive white porphyry, consisting of orthoclase felspar, dark mica, and (rare) crystals of hornblende. *On the N.E. flank of the western range* blue shales and sandstones full of *Productus Clarkei* are seen dipping at about 10° to N.E. The horizon of these beds is in all probability between the sections described in pars. 134 and 137.

141. *On the western slope of the eastmost porphyry range* blocks of ironstone and limestone, with the remarkable structure known as cone-in-cone are, plentiful. These rocks, if they occur *in situ* beneath the spot where their *débris* has been observed, probably overlie the strata referred to in par. 138.

142. A smaller creek falls into Parrot Creek from the south end of the eastern porphyry range. *For a quarter of a mile above this creek* the left bank of Parrot Creek (running N.N.E.) shows the following section, dipping to the north at about 10°:—

	ft.	in.
Shales (rising from below strata in par. 139)		
Gap		
Sheet of white porphyry in line of bedding	10	0
Shales, cut out in places by the porphyry	2	0
Red and yellow sandstone with pebbles of granite, &c.	9	0
Soft grey shaley sandstone	4	0
Total in continuous section...	25	0

143. *To*

143. *In the next reach of the creek* (S. 20 E. for about a quarter of a mile) the following section occurs. Dip 5° to S. 20° E.:—

	ft.	in.
White thick bedded sandstone (good building stone)	20	0
Yellowish and reddish shales and flags	30	0
Dark-blue shales, with a purplish tinge; strongly impregnated with *alum*, which effloresces in white crystals	12	0
Sandstone with a reddish tinge—groups of pebbles	3	0
Dark-blue sandy shale, with pebbles	1	6
Reddish sandstone, with pebbles	1	6
Dark-blue shales	4	0
Ferruginous sandstone full of fossils—*Productus Clarkei, &c.* (Specimens marked 4¼" m. up Parrot Creek)	0	10
Dark-blue shales impregnated with *alum*	10	0
Total in a continuous section	82	10

144. *After a short bend to S.W. the creek again turns to S.S.E. for about a quarter of a mile*, and the following section is seen on the right bank. The dip is slightly up stream—nearly horizontal at south end. The strata apparently underlie those in the preceding section:—

	ft.	in.
Flaggy sandstone	15	0
Dark-grey shales	30	0
Reddish sandstone, with pebbles	2	0
Soft white shale	1	0
Soft reddish sandstone, with rootlets	1	2
Soft sandy shale, with rootlets and pebbles	4	0
Soft reddish sandstone, with *Productus cora, &c.*	0	9
Soft dark sandstone	2	0
Dark-grey shales	20	0
Total in continuous section	75	11

145. A dyke of yellow porphyry, 30 feet broad, cuts the strata noted in the preceding section. It has a slight underlie to the north-west. Its direction is E. 30 N. It produces no vertical displacement in the strata. It has caught up and hardened numerous large angular fragments of dark shale and sandstone. [*For a sketch of this dyke see fig. 6 on next page.*]

146. *The stream next bends to S.W., which direction it keeps for about half-a-mile, and shows on its left bank* 20 or 30 feet of grey shales and thin-bedded soft ferruginous sandstone, with rootlets, dipping slightly down stream.

147. *The next reach of the creek, about quarter of a mile long, trends N. and S. The right bank exposes* the strata seen in last section, but here dipping slightly up stream (S). The grey shales are seen to be penetrated by upright rootlets.

148. *For the next quarter of a mile the creek runs E. and W. The left bank shows* grey shales on a 4 feet bed of conglomerate (pebbles and boulders of granite, porphyry, greywacke, and slate). An intrusive sheet of porphyry (6 feet thick) takes the plane of bedding, and rests on grey shales and reddish ferruginous grits with *Fenestella* (same species as in Coral Creek below Sonoma).

149. *The next higher reach of the creek* (about half-a-mile long) runs due north. In the middle of the reach a mass of pale felstone is seen, probably an intrusive sheet. Near the south end of the reach a mass of pale-coloured tough porphyry occupies the bed of the creek.

150. *The creek now turns S.W., and the right bank shows the following section* of horizontal strata:—

	ft.	in.
Yellowish sandy shales	35	0
Dark soft sandstone or sandy shale, with pebbles here and there, and vertical rootlets, covered with a white efflorescence of *alum*. [Specimen marked "8 m. up Parrot Creek"]	6	0
Reddish concretionary sandstone, with the *Fenestella* of Coral Creek... ...	0	8
Dark soft sandstone, with upright rootlets; contains one boulder of diorite measuring 2 cubic yards...	6	0
Dark shaley sandstone	1	0
Reddish sandstone, with *Productus, Streptorhynchus*, &c.	2	4
Dark pebbly shale	2	0
Total in continuous section	53	0

151. *After about half-a-mile on the west reach* (S.W.), about 15 feet of grey shales and sandstones are seen resting on 30 feet of grey shales, with large rounded pebbles, and crammed with *Productus Clarkei* and a few *Streptorhynchi*. These strata dip N.E. at 5°, and probably underlie those detailed in the preceding paragraph.

152. *For the next* 400 *yards* no rock is seen. Then a further thickness of about 40 feet of shales, full of *Productus Clarkei*, on 25 feet of grey shales and reddish pebbly sandstone. The dip of these beds is the same as in last section, which they seem to underlie.

153. *The next bend of the creek* (*quarter of a mile to N.W.*) shows a cliff of about 40 feet high, of dull yellow sandstone. The dip is doubtful, but appears to be to the S.W.

154. *At the next bend* (*to S.W.*) is a sheet of intrusive porphyry.

FIG. 6.

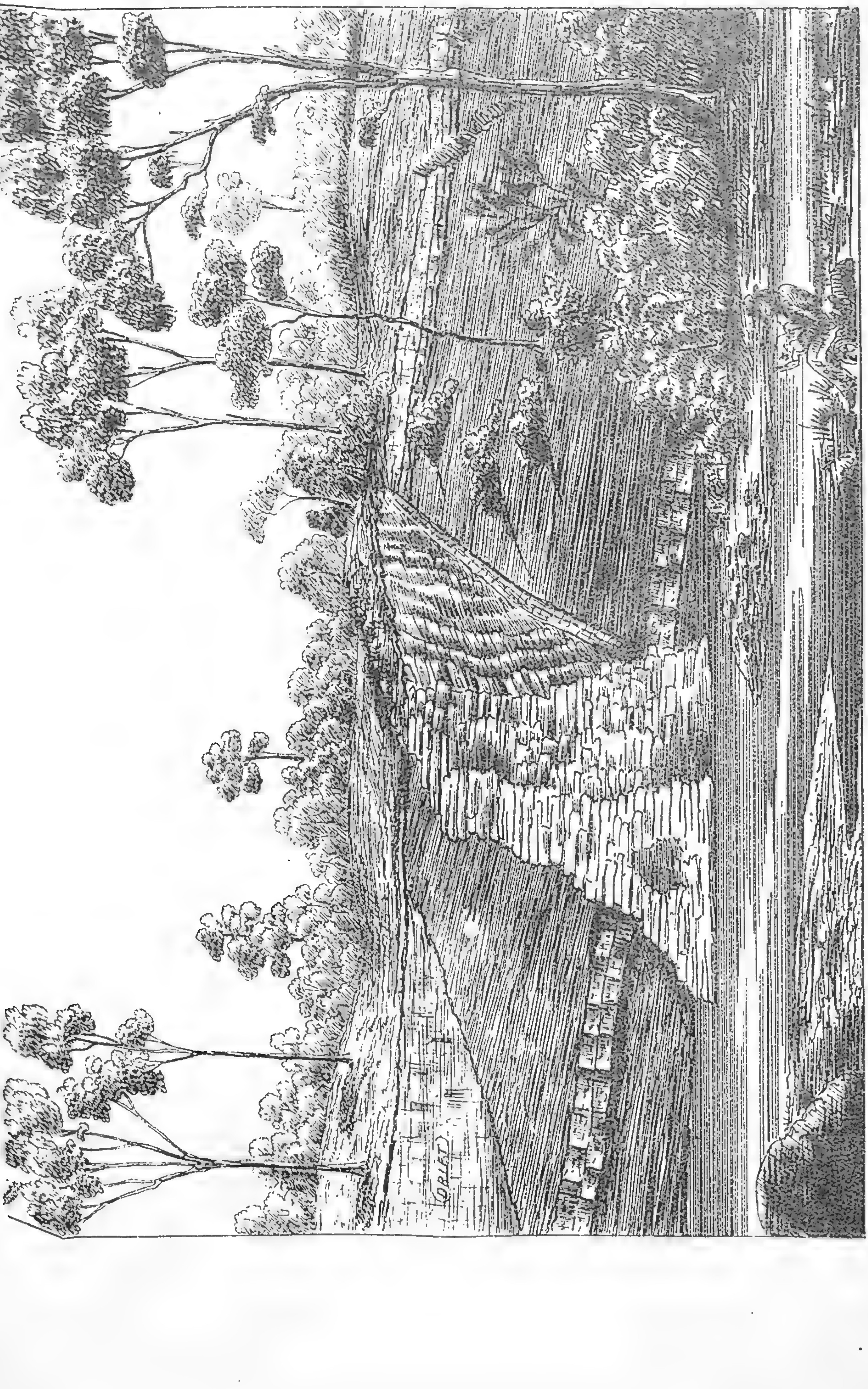


Fig. 6.—Porphyry Dyke intersecting Carboniferous Shales, Etc., Six Miles up Parrot Creek

155. *The creek now turns S.W. for a quarter of a mile, and shows on left bank* 30 feet of grey sandy shales on 20 feet of soft dark-grey rootlet-pierced sandstone. Dip, N.E.

156. *At next bend of creek,* a thickness of about 12 feet of white sandstone is seen.

157. *The creek now bends S.S.W. 100 yards up this reach.*—8 feet of grey gritty and pebbly sandstones rest on 12 feet of grey shales.

158. *Above the last reach,* the creek divides, and encloses an island a quarter of a mile in length. At the upper end of the island are seen thick-bedded white sandstones dipping at 5° down-stream (east).

159. *The creek continues, in a deep wide waterhole three-quarters of a mile long, in a segment of a circle from W. to N.W. For about a third of this distance* white thick-bedded sandstones are seen dipping to the east at 5°.

160. *At the end of the waterhole* is a 30-feet cliff of horizontally-bedded yellow and white sandstone.

161. *The creek next turns S.W. for a quarter of a mile. At the end of that distance* hard thick-bedded sandstone (good building stone) is seen dipping at 5° to N.E.

162. The creek runs west for a quarter of a mile, and W. 20 N. for half-a-mile, at least. I followed it no further, as there was nothing in the gravel brought down by it to indicate the presence, higher up, of the freshwater series.

f.—UPPER (MAINLY FRESHWATER) SERIES OF THE COALFIELD.

163. It is impossible, at present, even to guess at the thickness of this series, none of the sections traversed revealing its uppermost beds. It is only safe to say that the strata are at least 1,000 feet thick.

JACK'S CREEK.

164. *The strata in Jack's Creek, for about 3 miles north of the river,* are horizontal, so that their thickness is equal to the fall of the creek—apparently less than 200 feet. The section is, however, very imperfect, the rocks being only exposed at long intervals, except in the lower reaches of the creek. These are invariably either grey shales or greenish-grey sandstone, sometimes pebbly.

165. *About one mile north of the river* a thickness of about 50 feet of greenish-grey sandstone is seen, containing numerous large drifted trees (coniferous). These occasionally retain some part of the branching roots. They are silicified to a black flint, sometimes partly opalised. Fragmentary plant-remains in a carbonised condition are also common.

166. *About half-a-mile from the river* the creek divides. Both branches show, for some distance up, sections of the greenish-grey pebbly sandstone, with silicified drift-trees. One tree was found to measure 31 feet in length, and tapered from 12 inches to 3 inches in diameter.

167. *Near the mouth of the creek* is seen the section, of which a sketch is given in fig. 7:—

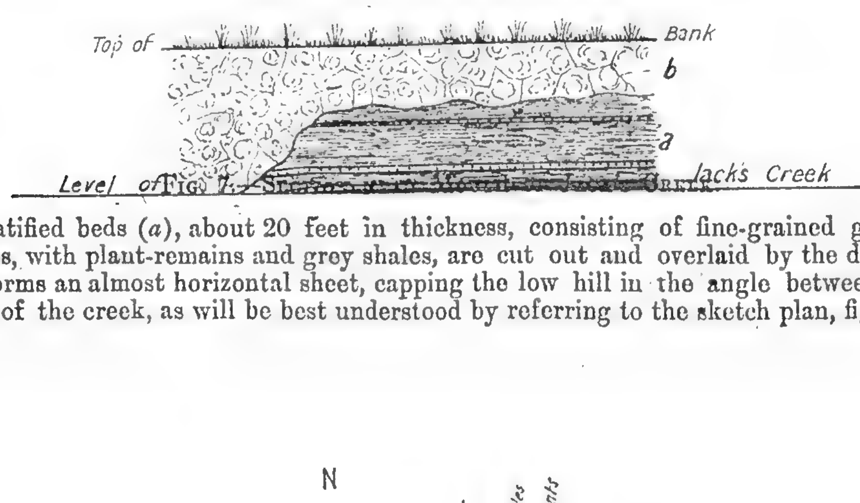


Fig. 7.

The stratified beds (*a*), about 20 feet in thickness, consisting of fine-grained grey argillaceous sandstone bands, with plant-remains and grey shales, are cut out and overlaid by the dolerite sheet (3). This dolerite forms an almost horizontal sheet, capping the low hill in the angle between the river and the right bank of the creek, as will be best understood by referring to the sketch plan, fig. 8:—

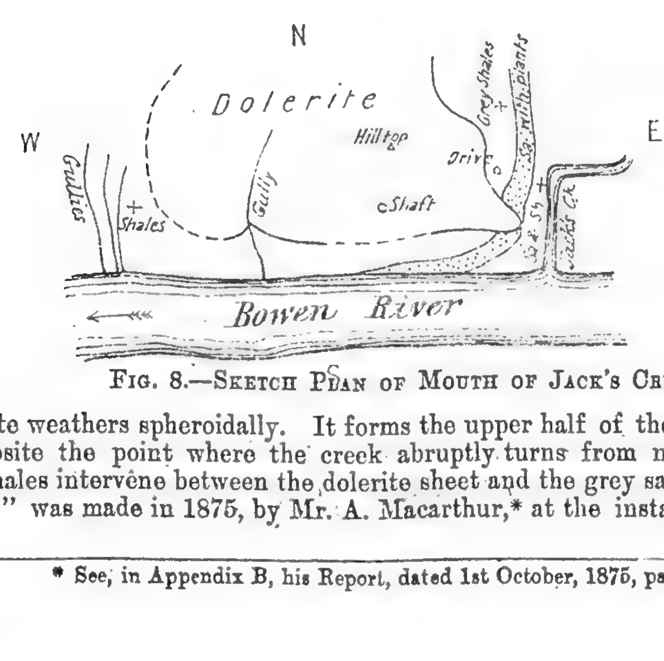


FIG. 8.—SKETCH PLAN OF MOUTH OF JACK'S CREEK.

The dolerite weathers spheroidally. It forms the upper half of the hill.

168. Opposite the point where the creek abruptly turns from north to east, about 20 feet of horizontal grey shales intervene between the dolerite sheet and the grey sandstone. Near the base of the dolerite a "drive" was made in 1875, by Mr. A. Macarthur,* at the instance of the Bowen River Coal Association

* See, in Appendix B, his Report, dated 1st October, 1875, paragraph 1st.

Association, on a 5 ft. seam of coal. The coal is not now visible, owing to the falling in of the drive. From the position of this seam, there can be little doubt of its identity with the "Macarthur seam," on the opposite side of the river. The coal appears from Mr. Macarthur's account, to have been worthless; a fact sufficiently accounted for by the proximity of the intrusive sheet of dolerite.

169. In the shaft referred to in the third paragraph of Mr. Macarthur's Report of 22nd December, 1875, an attempt was made to reach the coal seam (which had already been traced at its outcrop for some distance round the slopes of the hill) beneath the dolerite sheet, but the latter was found to be so hard, that, at a depth of 15 feet, the attempt was abandoned. Mr. Macarthur was under the impression that the dirty, soft, crumbling, incombustible condition of the coal was due to weathering near the outcrop of the seam, and hoped to obtain better results by cutting the coal as far as possible into the hill. But as the deterioration of the seam in question is due to the presence of the mass of dolerite, there is every probability that even if the dolerite had been pierced, the underlying coal would have been found to be little better than that at the outcrop of the seam.

170. *About three miles up the creek,* 5 feet of grey shales, resting on 2 feet of dark shales, dip to the S.E. at 7°, and probably underlie all the sections above given.

171. *Between this point and the road crossing* occasional outcrops of grey shales and sandstone occur, but no continuous sections worth noting.

172. 100 *yards up the creek above the road* is a sheet of dolerite with a low dip to the south-west.

173. *Half-a-mile higher* greenish-grey sandstones occur. Dip, if any, uncertain.

174. 250 *yards higher,* grey sandstone beds weathering in large spheroids, with shales and thin bands of good dark-blue crystalline limestone, are seen on the left bank. They dip at 80° to W. 20° S.

175. The sandstone continues on end, or nearly so, for about a quarter of a mile. It appears to have been hardened. Then *(nearly opposite a tree marked W. H.)* a 20 feet dolerite dyke comes in on the left bank, running N.W. and S.E The grey shales and sandstones (hardened) in contact with the north-east side of the dyke strike N. and S., with a quite vertical dip.

176. *Quarter of a mile higher* (trend of creek E. and W.) a section is seen in the bed of the creek, of which the following sketch-plan (fig. 9) will give the best idea:—

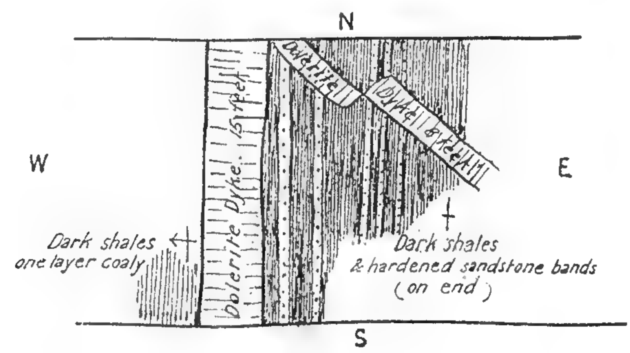
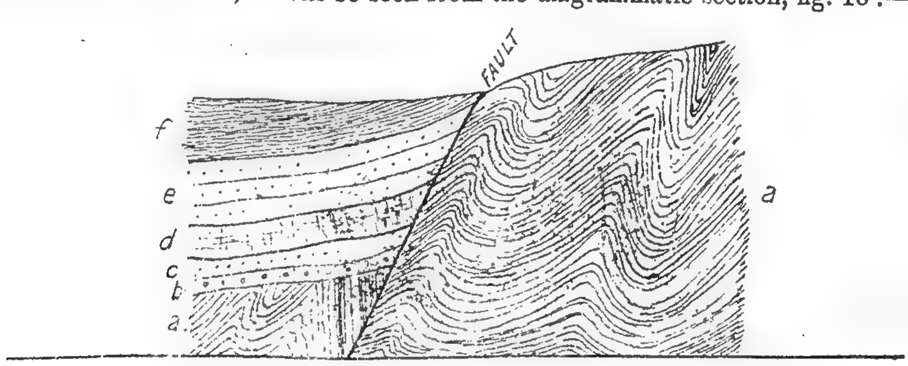


FIG. 9.—GROUND PLAN OF PART OF BED OF JACK'S CREEK.

177. In another quarter of a mile the metamorphic rocks are met with, consisting here of quartzites, greywackes, and hard black slates. The latter beds contain occasionally minute specks of pyrites.

178. As the freshwater beds of the coalfield and the metamorphic rocks are here in contact, they must be divided by a fault, with a downthrow equal in amount to at least the total thickness of the inferior members of the coal measures, as will be seen from the diagrammatic section, fig. 10:—



f. Beds belonging to upper or freshwater series.
e. Position of marine series.
d. Position of volcanic series.
c. Position of lower series.
b. Position of volcanic agglomerate.
a. Metamorphic rocks.

FIG. 10.—SECTION AT HEAD OF JACK'S CREEK, SHOWING RELATIONS OF THE FRESHWATER BEDS OF THE COALFIELD AND THE METAMORPHIC ROCKS.

179. A

179. *A low ridge on the east side of Jack's Creek*, 2 miles north of its mouth, covered with "bottle-tree scrub," is strewn with fragments of ferruginous sandstone, ironstone full of *Glossopteris*, silicified wood, and lumps of sulphate of lime stained with carbonate of copper.

MACARTHUR CREEK.

180. This creek, or rather gully, falling into the river nearly opposite the mouth of Jack's Creek, gives naturally (the strata being horizontal) a section of the same beds. The following are seen about a quarter of a mile from the river :—

		ft.	*in.*
MACARTHUR COAL SEAM.	Dolerite (on top of bank)	12	0
	Burnt *coal*	0	2
	Grey shale	5	0
	Burnt *coal*, with shaley layers	1	7
	Hard grey ferruginous sandstone	0	4
	Burnt shaley *coal*	1	7
	Grey-brown sandstone, with plant impressions ... ... 3 in. to	0	7
	Grey shales	0	8
	Darker shales, with coaly laminæ (one is ¼-in. thick)	0	9
	Bituminous *coal* (tolerable)	0	1
	Grey sandstone	0	1
	Coal crumbling and with shale laminæ—the coal laminæ of fair quality—1 ft. 2 in. to	1	9
	Grey shaley fireclay, with rootlets	0	4
	Darker shale	0	8
	Grey-brown ferruginous shale—a mass of *Glossopteris*...	0	4
	Crumbling brown shale	0	5
	Grey-brown ferruginous shale—a mass of *Glossopteris*	0	3
	Grey shale with *Glossopteris* and *Sphenopteris ?*	4	0
	Grey sandstone, thin-bedded, with occasional plant-remains	30	0
	Total in continuous section	60	2

The coal seam in the above section, which I have named the "Macarthur" seam, is the one referred to in Mr. A. Macarthur's Report of 1st October, 1875 (under heading 3rd), and 22nd February, 1876; in Mr. A. C. Gregory's Analysis; in Mr. Archibald's letter to Mr. Graham; and apparently in Mr. Daintree's letter of 16th April, 1876 (see Appendix B).

181. In Macarthur Creek, as in Jack's Creek, the intrusion of the dolerite sheet has rendered the coal almost unfit for use. The layers which are of better quality are too thin to be worked with profit under the most favourable conditions imaginable.

182. It will be observed that Mr. Daintee and Mr. Gregory both attribute the poorness of the coal to the samples having been taken from near the outcrop; but it is fair to mention that neither of these geologists had been apprised of the presence of the dolerite—in fact, this circumstance does not appear to have been noticed by anybody. Mr. Macarthur, although actually baffled by its hardness in his attempt to blast his way through the dolerite sheet on the hilltop west of Jack's Creek, supposed it to be a sandstone.

BOWEN RIVER.

183. For five miles down the river from Jack's Creek, to the 18th Traverse Station, no rock is exposed. From that point to near the mouth of Parrot Creek the strata observed dip for the most part east, and therefore probably underlie the horizontal strata at the mouth of Jack's and Macarthur creeks. The sections met with in going down the river follow each other in descending order.

184. *At the 18th Traverse Station* a bed of brown sandstone, dipping north at a low angle, breaks the current into rapids for a short distance.

185. *Half-a-mile lower* a sheet of dolerite, at least 20 feet in thickness, is seen resting on a 3-foot bed of dark coaly shale. The dip, which is very slight, is up-stream. The lower part of the dolerite in contact with the carbonaceous shales has been converted into "white trap."

186. *A quarter of a mile lower*, 10 or 12 feet of soft brown sandstone dip to E. 20 S. at 5°. Similar beds with the same dip occur again about 100 feet lower.

187. 100 *yards below last section* the top of a sheet of dolerite is seen in the bed of the creek.

188. *Near No. 19 Traverse Station* a little gully falls into the right bank of the river. In one place it exposes coaly clay (1 foot) overlying 6 feet of grey shales with carbonised plant-remains. A few yards down the gully the following strata are met with (also horizontal) :—

	ft.	*in.*
Grey shales, with plant-remains	6	0
Oil shale (poor)	0	10
Coal—good, bituminous	0	2
Black shale	0	4
Coal	0	1
Total	7	5

189. *At the mouth of the gully* the river falls over a sheet of dolerite 4 feet thick, which dips up-stream (east) at a low angle. On the opposite side of the river the dolerite is seen to rest on a 3-feet seam of burnt coal.

190. *About*

190. *About a quarter of a mile below the mouth of Rosella Creek,* a sheet of dolerite, about 25 feet thick, occupies the bed of the river for 100 yards of its course. The lower part is "white trap." Its actual base is concealed by a talus, a gap of perhaps 10 feet intervening between the dolerite and the strata next seen. The following is the section, which dips to E.S.E. at 7° :—

References to Notes par. 343.

		ft.	*in.*
	Dolerite, the lower part "white trap"	25	0
	Gap—room for	10	0
Daintree Coal Seam.	Burnt *coal,* partly columnar; somewhat coked in part; veins and pockets of "white trap" in upper part; concretions of ironstone in vertical and horizontal joints; nodules of decomposed pyrites; *Glossopteris* recognisable in parts	3	7
	Black shale	0	1
	Burnt *coal*	0	3
	Black shale	0	1
	Burnt *coal*	0	6
	Black shale	0	1
	Burnt *coal*	0	10
	Bluish-grey shales	1	2
	d Stony burnt *coal,* with silky plant debris...	0	6
	c Light porous crumbling *coal,* with concretionary nodules of better *coal* ...	0	8
	Coaly shale	0	2
	b Light brownish-black laminated *coal* (some of the laminæ rather *oil shale* than *coal*) fair quality	7	0
	Bluish-black shales...	2	3
	a Good *coal*	0	3
	Dark-blue shales, with *Phyllotheca,* &c. (some laminæ coaly) say	10	0
	Flaggy brown sandstone, with plant-remains	0	10
	Ironstone	0	1
	Bluish-grey shales	1	6
	Brown sandstone, with ferruginous concretions	0	3
	Brown flaggy sandstone, with plant-remains	1	6
	Grey shales, with a 1½-inch band of good clayband *ironstone*	4	0
	Total in almost continuous section	70	7

Field Notes on the above section.

a Burned well and took fire easily; fierce heat; caked; emitted much gas; left little ash.

b The outcrop of the seam is covered with gravel, but the thickness was estimated from a trench dug through the gravel at right angles to the line of strike. Bottom of this seam rather slaty, with alternate dull and shining laminæ, took fire with difficulty, fire went out after four hours and left a good deal of ash. Top of the seam took fire easily, crepitated loudly at first, emitted a good deal of gas, fell away, leaving little ash except from some shaley laminæ.

c The nodules hardly burned at all; they are "stone, in fact."

d Burned slowly and left much ash; glowed a long time.

191. This coal seam, which I have named "the Daintree," would certainly, but for the presence of the dolerite, have been quite good enough, as it certainly is thick enough to be profitably worked.

192. No further section is seen for two miles and a-half down the river, when the beds already described as belonging to the marine series are first met with.

COCKATOO CREEK.

193. Commencing at a point about three miles south-east of the outcrop on the Bowen River, of the Daintree seam; the strata observed in Cockatoo Creek, down to about a mile from its junction with Parrot Creek, belong to the freshwater series, and as they dip up stream (S.E.), they, in all probability, overlie the Daintree seam.

194. Up the creek from this point a reverse dip prevails; so that, in going up, the outcrops of the strata are again traversed in descending order.

195. Beginning at the point in question, the following sections are seen in descending order:—

196. *Three miles S.E. of outcrop of Daintree Seam.* Dip E. at 5° :—

	ft.	*ins.*
Soft brownish sandstone, weathering yellow, with indistinct plant remains (carbonised), with partings of bluish-grey mudstone	30	0
Alternate bands of grey shale and bluish-grey, finely-laminated hard mudstone, with *Glossopteris,* &c. [Specimens marked "3¾ miles up Cockatoo Creek"]	25	0
Total in continuous section	55	0

Below this section lumps of silicified wood are common.

197. *Shortly after this section,* the creek runs E. and W. for about a furlong across the outcrop of a sheet or bed of porphyrite dipping east, and probably underlying the shales referred to in par. 196.

198. *Quarter*

198. *Quarter of a mile below section in par.* 196, and apparently underlying the porphyrite mass last-mentioned. Dip S. at 5° :—

	ft.	ins.
Grey fine-grained cross-bedded sandstone	6	0
" shales	3	0
" sandstone	1	0
" shales	3	0
" sandstone	1	4
" sandy shales	3	6
Bluish-grey finely laminated sandstone (whetstone), with indistinct plant remains (*Glossopteris*, &c.) ... ... [Specimen marked "3 miles up Cockatoo Creek."]	0	6
Grey shales	0	5
Alternate grey shales and grey finely laminated sandstone; one bed of soft sandstone containing a large frond of *Glossopteris*	26	0
Brown or yellow sandstone, with indistinct plants and partings of grey laminated sandstone	30	0
Total in continuous section	74	9

199. *Half-a-mile lower*, grey sandstones and shales dip S.E. at 10°.

200. *Shortly below this*, the bed of the creek narrows and is almost choked up with "oaks." From this place down the creek blocks of coal are common in the sand and gravel, the presumption being that a coal seam crops out hereabouts. I failed, however, to find it, either in the creek or in any of the tributary gullies.

201. *Three-quarters of a mile down the creek*, 6 feet of soft grey sandstones and reddish ferruginous sandstones are seen dipping at 15° to the S.E.

202. *A quarter of a mile below this*, a dyke of dolerite crosses the creek.

203. *For the next half-mile*, lumps of coal are seen at intervals in the bed of the creek—generally very stony, but mixed with a few fragments of a better quality (resembling the Garrick seam).

204. *At the lower end of this half-mile*, a bar of pale felstone crosses the creek.

205. *A furlong lower*, 2½ feet of yellow sandstone are seen resting on 12 feet of grey and yellow flaggy sandstones, dipping at 10° to the S.E. These are the lowest of the freshwater beds visible in Cockatoo Creek; the next reach, about half-a-mile distant, exposing strata already described as belonging to the marine series. The Daintree seam probably comes in between, and as it does not appear at the surface it is likely not accompanied here by the destroying mass of igneous rock.

206. As has already been mentioned, the dip is reversed at the point referred to in par. 193, so that if we commence to ascend the stream from that point we get another set of sections, following one another in descending order.

207. *A furlong above the strata referred to in par.* 193, a dolerite dyke, 12 feet broad, running N.E. and S.W., cuts through 12 feet of brown sandstone on 10 feet of bluish shales with *Glossopteris*. The dip is to the N.E.

208. *A mile and a-half above this* a thick sheet of yellow felstone dips at 35° to the north-east.

209. *Shales are seen three-quarters of a mile above this*, dipping to N.E. at a low angle. A furlong higher, 30 feet of cross-bedded, soft, greyish-brown sandstones occur.

210. *Half-a-mile higher*, a bar of porphyry (an intrusive sheet) crosses the stream.

211. *A quarter of a mile up stream*, a tough brown sandstone, weathering like porphyry, is seen on the left bank, dipping slightly to the north.

212. 220 *yards higher*, a brown sandstone is seen on the right bank, very like that referred to in par. 211. It may possibly be the same bed. There is no recognisable dip.

213. *Half-a-mile higher*, a lump of *coal* was seen in the creek.

214. *A furlong higher*, 20 feet of yellow sandstone and shale, dipping at 25° to E. 20° N.

215. A lump of fair coal was seen in the bed of the creek *a little more than half-a-mile higher up*.

216. The strata seen above this point dip in all directions, and the order of their sequence cannot be determined, as long gaps occur between the different sections.

217. *Three-quarters of a mile above the section given in par.* 215.—Dip S.W. at 5° About 20 feet of bluish-grey shales, with bands (6 to 18 inches) of fine grained hard yellow ferruginous sandstone, with ironstone nodules in parts, and softer brown or yellow gritty sandstone. The ironstone nodules are *good* clayband, and are sometimes marked "*Glossopteris*." [Specimens marked "11 miles up Cockatoo Creek."] Silicified wood is plentiful—derived apparently from the upper part of the section.

218. *A quarter of a mile higher*, rocks similar to those in last section have tumbled from the right bank, at the base of which are white sandstones and grey shales, with a slight dip to N. 20 W.

219. *For the next half-mile* grey shales and white sandstone are seen at long intervals, with a slight dip up stream. Small coal fragments are pretty common in the gravel.

220. *About*

220. *About* 1,000 *yards higher*, at a bend of the creek, the following strata are seen on left bank, dipping east at 5°:—

	ft.	ins.
Soft brownish yellow sandstone, with very indistinct plant-remains, and bands of (good) ironstone nodules	20	0
Brown flaggy sandstone, with bands of *ironstone* nodules	5	0
Grey shales, with thin *ironstone* bands	8	0
The shales are full of plant-remains in good preservation, but are very brittle. [Preserved specimens of *Glossopteris* and *Phyllotheca*, marked "12 miles up Cockatoo Creek."]		
Concretionary ferrugious hard yellow sandstone	0	10
Grey shale	2	6
Grey-brown soft flaggy sandstone, with *Glossopteris* and bands of *ironstone* nodules	4	0
Shales with bands of ironstone nodules	10	0
Total in continuous section	50	4

221. *For the next quarter of a mile* the strata in the above section are seen at intervals, dipping to E. 20 N.

222. *In a quarter of a mile, the creek receives a large tributary from the south-west. A quarter of a mile above this tributary,* the following section is seen on left bank, dipping east at 8°, and therefore probably overlying the strata given in par. 220:—

	ft.	ins.
Black carbonaceous shale, some laminæ coal, and a 1-inch seam of *blackband* ironstone	5	0
Decomposing white porphyry (intrusive sheet)	8	0
Black shale	0	6
Grey flags	1	0
Brownish-black rooty bed (coal smut)	0	3
Hard grey shales	1	0
Total in continuous section	15	9

223. *Half-a-mile higher,* 50 or 60 feet of dark-grey shales, with thin partings of soft yellow and reddish concretionary sandstone, occur in a trough, dipping east at the west end of the section, and west at the east end. The dark-grey shales are highly impregnated with *alum.* I left the creek at an island (about 60 feet long, with six tea-trees) about three-quarters of a mile further up, no more rock having been seen.

ROSELLA CREEK.

224. *The rocks in Rosella Creek,* as far as I followed it up—to the north of Rudolph Creek, some 15 miles—all belong to the upper or freshwater division of the Coal Measures, with the exception of some beds containing marine fossils, which appear to indicate a temporary and perhaps local suspension of the lacustrine conditions under which the upper series was deposited.

225. *For about seven miles up the creek,* the dip is pretty steadily to the south-east (up-stream), so that in following the creek down from that point the sections are encountered in descending order.

226. *Between Traverse Stations* 8 *and* 9, a small outcrop of white trap, involving grey sandstone, is seen on the left bank.

227. *On side of road from Havilah to Byerwin, one mile above crossing of Rosella Creek,* grey and reddish ferruginous sandstones, with slight dip to south. Marine fossils numerous and well-preserved. *Streptorhynchus crenistria* specially abundant. [Specimens marked "Rosella Creek, 2 miles above Havilah paddock" and "Havilah, Byerwin road, 1 mile south of Rosella Creek crossing."] Loose blocks of silicified wood, apparently from a higher, denuded, bed, cover the shell-bed.

228. *At the road crossing*—Grey sandstone, with silicified trees.

229. *Where Havilah Paddock fence crosses creek:*—

	ft.	ins.
Dolerite sheet on top of left bank		
HAVILAH COAL SEAM, burnt by "white trap" intruded along bedding, rendered columnar, especially in upper part (see sketch, fig. 11)	10	6
About 200 yards up the creek the place of the coal is taken up by the sheet of dolerite, which steals down into it.		
Dark and grey shales, with a 2ft. bed of soft worthless *coal* in the middle ...	30	0
Greenish-grey sandstone, with trees.		
Blue-grey shales, with plants, and lenticular seams of *coal* and calcareous bands, and bands of *ironstone* nodules (slight dip to N.E.)		

The shales appear to die out up stream, and a considerable thickness of greenish-grey sandstone takes their place. A quarter of a mile higher, the sandstone is pierced by a $3\frac{1}{2}$ feet dolerite dyke running E. 10 N., and the lower coal seam is again seen on the left bank.

230. The 10ft. 6in. seam is the one referred to by Mr. Macarthur in his Report, dated 1st October, 1875 (head 4th). His conjecture that this is the same as the seam on Jack's Creek (the "Macarthur seam"), I think is wrong; for the reason that I believe the thick series of blue-grey sandstones with trees, *above* the "Macarthur seam," to be identical with that which occurs *below* the Havilah seam.

FIG. 11.

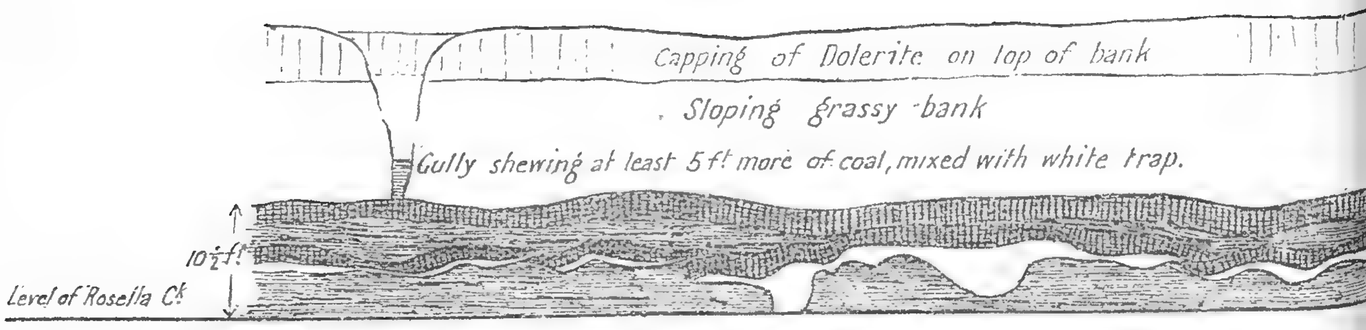


Fig. 11.—Havilah Coal Seam, Rosella Creek, burned and partly rendered Columnar by White Trap.

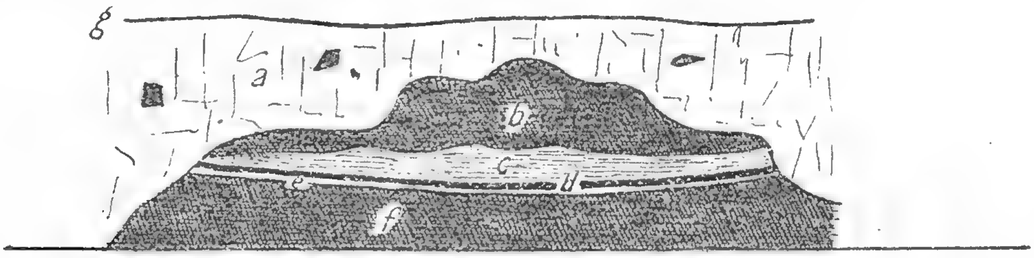
231. *A quarter of a mile W. of the creek*, on the road from Havilah to Biralee, large silicified trees lie on the surface. In one, I counted about 30 rings of growth. The strata from which these trees have weathered probably underlie the Havilah Coal Seam.

232. *Between 2nd and 3rd Traverse Stations* (right bank). Dip, S. at 15°:—

	ft.	in.
Bluish cross-bedded sandstone, weathering spheroidally, full of carbonised and silicified plants, including coniferous trees. Large unrounded boulders of metamorphic rock occur sporadically throughout. About	150	0
Dolerite sheet	10	0
Grey shales and finely laminated sandstone, with thin bands of sandy ironstone	60	0
Total, in continuous section	230	0

233. *About* 100 *yards above No.* 2 *Traverse Station*, a dolerite sheet is seen, involving lumps of coal and probably occupying the place of a coal seam. Dip, S. at 15°.

234. *At the No.* 2 *Traverse Station*, a sheet of intrusive dolerite, at least 20 feet thick, crosses the creek and ponds back a large waterhole. It dips to the south at 15°. At the west side, large blocks of burnt coal are involved in the dolerite (one containing at least 1,000 cubic feet); while, at the east side, the following section (Fig. 12) remains to attest the presence of a good coal seam before the destroying mass of molten dolerite forced its way among the beds.



g. Burnt *coal*, 3 inches.
a. Dolerite—"white trap" in part, involving angular blocks of coal.
b. Burnt *coal*, upper part columnar, 3 feet 6 inches.
c. Blue shale, topmost part hardened, 2 feet 1 inch.
d. Burnt *coal*.
e. Black clay, 3 inches.
f. Burnt *coal*, 3 feet.

Fig. 12.—Coal Seam destroyed by intrusive Sheet of Dolerite, No. 2 Traverse Station, Rosella Creek.

235. *At the bend below No.* 2 *Traverse Station.*—20 feet of dolerite, with uneven bottom, on grey shales and sandstones.

236. *Quarter of a mile above No.* 1 *Traverse Station* (just above a deep scrubby gully on left bank).—20 feet cliff of dolerite on top of bank.

237. *At No.* 1 *Traverse Station.*—High up on bank. Dip, S. at 10°. Dolerite 6 feet, on yellow sandstone.

238. *One furlong below No.* 1 *Traverse Station.*—Dolerite in bed of creek. Its relation to the stratified rocks not seen.

239. *In a little gully entering right bank of creek, half-a-mile from mouth.* (Bedding horizontal):—

	in.	ft.
Dolerite (intrusive sheet) weathering spheroidally	15	0
Hardened blue shales (see Fig. 13)	0	6
Blue shales, with plants	1	3
Lenticular *ironstone* band	0	4
Blue shales	0	4
Soft lenticular *coal* seam	0	1
Ferruginous shales...	0	6
Blue shales, with plants	0	9
Lenticular *coal* seam	0	0½
,, *ironstone*	0	0½
Blue shales	1	6
Lenticular mass of mineral pitch (see Fig. 14) ... ... 0 to	0	4
Blue shale, with plants, and very thin lenticular *coal* and *ironstone* seams ...	3	0
Total, in continuous section	23	8

Fig. 13.

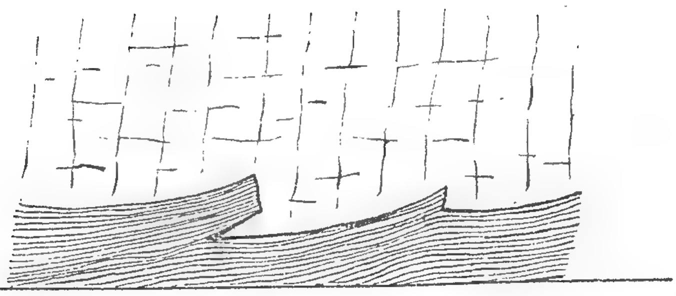


FIG. 13.—VERTICAL SECTION, SHOWING JUNCTION OF SHALES AND INTRUSIVE DOLERITE SHEET.

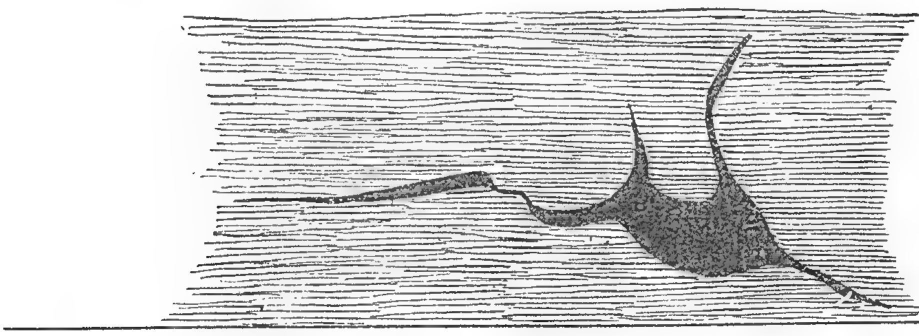


FIG. 14.—VERTICAL SECTION OF SHALES, WITH "POCKET" OF MINERAL PITCH.

240. *Quarter of a mile from mouth of creek.* Dip, S.E. at 10° :—

	ft.	in.
Brownish-yellow sandstone	2	0
Soft grey sandy shale	1	10
Clay band *ironstone* (fair)...	0	4
Grey sandy shale	1	2
Gap—room for	3	0
Indurated blue shales	0	8
Dolerite sheet	10	0
Total, in almost continuous section	19	0

241. Above the 9th Traverse Station the constant south-easterly dip which has given us a descending section (with very large gaps) from that point to the mouth of the creek, no longer obtains. The order of succession of the following sections met with in going up the creek is uncertain.

242. *Half-a-mile above the 9th Traverse Station.*—10 feet of thin-bedded grey sandstone and shales. Slight dip to N.N.W.

243. *Quarter of a mile higher.*—Dolerite, with amygdala of carbonate of lime, in bed of creek.

244. *Quarter of a mile higher.*—Dull grey sandstone in bed of creek. Dip uncertain.

245. *Two miles higher (between Stations 11 and 12.)*—Horizontal shales—grey with a reddish tinge.

246. *Half-a-mile higher, in a little gully on left bank.*—Grey sandstone and shale. Dip, N.E. at 10°.

247. *Opposite the mouth of Rudolph Creek.*—Dull grey sandstones are seen dipping N.E.

248. *One hundred yards above mouth of Rudolph Creek,* a bar of dolerite (intrusive sheet) crosses the creek, with an apparent dip up-stream.

RUDOLPH CREEK.

249. From the frequent changes of dip, and long gaps between the sections, I cannot venture to arrange the sections in their order. The following is a mere record of what, at the date of my visit, was visible in the creek from the Byerwin road downward.

250. *At road crossing.*—In bed of creek and on neighbouring hillocks, a very tough diorite. The boulders from higher up the creek are mostly all of metamorphic rocks, with a very few of hardened sandstone, some fragments of silicified wood, a few haematite pebbles, and a few opals. In all likelihood, the carboniferous rocks do not extend very far up the creek.

251. *Half-a-mile below road.*—Coarse white grit. Dip uncertain.

252. *Quarter of a mile lower.*—Soft calcareous grit. Dip uncertain.

253. *One mile further.*—Soft yellow grit. Dip, W. at 40°.

254. *Two hundred yards lower,* a bar of dolerite crosses the creek.

255. *One hundred yards lower.*—Blue shales; nearly on end. Dip, south.

256. *Fifty yards lower,* another bar of dolerite.

257. *Fifty yards lower.*—Black shales, with *Glossopteris;* thin sandstone beds and blue shales; on end. Strike, N. 18° W. A 20 feet dolerite dyke in line of strike.

258 *For the next half-mile,* occasional confused crops of dolerite, sandstone, and blue shale are met with.

259. *At*

259. *At Waterfalls.*—Dolerite sheet, with slight S.E. dip. This sheet continues on banks of creek for nearly a quarter of a mile, and then horizontal bluish sandy shales are seen.

260. *For the next two miles*, occasional short sections of blue-grey shales are met with.

261. *Then* (dip 10° to N.E.) a considerable thickness of blue-grey sandstone and blue flags, under thick-bedded grey sandstone, with vertical rootlets. This is near the mouth of the creek.

262. Having now exhausted the notes made in the field on the various sections observed within the carboniferous area, the formation next in chronological order now falls to be described. Thereafter, the geological position and economic value of the coal measures will be discussed.

g.—SANDSTONES, &c., OF MOUNT LESLIE AND THE RED CLIFF RANGE.

263. Mount Leslie is but an outlying fragment of the great Red Cliff Range, composed of rigidly horizontal beds, which can be seen from the plains near Havilah, stretching southward as far as the eye can reach, like courses of massive mason work.

264. The strata composing this mass consist mainly of a coarse grit of well-rounded grains of silica, with a few quartz and felstone pebbles. Some beds are more felspathic. The grit is white or yellow, but often weathers with a reddish tinge.

265. The horizontal strata of Red Cliff Range and Mount Leslie lie unmistakably on the upturned edges of the coal measures, which they probably at one time entirely covered.

266. On the age of the deposit, which must have a thickness of at least 800 feet, I can throw no light at present, except that it overlies, and is consequently newer than the carboniferous rocks. Its relation to younger rocks has not yet been seen, and I was unable to detect in it any trace of organic remains. From its lithological character, however, I think I may say with confidence that it is distinct from the "Desert Sandstone." In all likelihood it is older—possibly cretaceous.

NOTES ON THE ORGANIC REMAINS AND AGE OF THE COAL-BEARING FORMATION.

267. Owing to the want of a Palaeontological library, as well as of specimens necessary for comparison, I cannot pretend to determine the fossils of the collection recently made, except approximately. Mr. Robert Etheridge, junr., F.G.S., Palaeontologist to the Geological Survey of Scotland, has undertaken this arduous task. The following is an *ad interim* list, to be cancelled as soon as the results of Mr. Etheridge's examination shall have been published. I include localities from which no specimens were carried away, but where I could name the fossils with certainty.

I.—LOWER SERIES.

No fossils from this series.

II.—MIDDLE OF MARINE SERIES.

269. *Cockatoo Creek, half-a-mile above junction with Parrot Creek.*

Brachiopoda.

Productus Clarkei (Etheridge).

Polyzoa.

Fenestella, sp.

BOWEN RIVER.

270. *Two miles above Beasley's Old Public-house.*

Brachiopoda.

Productus Clarkei.

271. *Stonehumpy Creek.*

Lamellibranchiata.

Pecten asiaticus, de Koninck.

Brachiopoda.

Productus Clarkei.
" Scabriculus.
Spirifera glabra, Martin.

Plantæ.

Rootlets.

272. *Between 25th and 26th Traverse Stations.*

Brachiopoda.

Productus Clarkei.
" Scabriculus.

273. *A quarter of a mile below 25th Traverse Station.*

Lamellibranchiata.

Pecten asiaticus, de Koninck.

Brachiopoda.

Productus Clarkei.

Plantæ.

Silicified coniferous wood.
Rootlets.

274. *Gully*

274. *Gully at 25th Traverse Station.*

Lamellibranchiata.

Myacetes, sp.
Panopaea, sp.

275. *Half-a-mile above Stonehumpy Creek.*

Brachiopoda.

Productus longispinus.

276. *At No. 25 Traverse Station.*

Lamellibranchiata.

Pecten asiaticus (de Koninck).

277. "*Twelve-mile Plain,*" above Stonehumpy Creek.

Brachiopoda.

Productus cora.

CORAL CREEK.

278. *Between Sonoma and mouth of creek.*

Gasteropoda.

A cast, undet.

Lamellibranchiata.

Myacites, sp. (Same species as in Bowen River, quarter of mile below 25th Traverse Station.)
Edmondia (?), sp.
Mytilus, like M. cinctus.
Panopaea sulcata (Eth).

Brachiopoda.

Productus cora.
Spirifera acuticostata (de Koninck).
Streptorhynchus Davidsoni (Eth).

Polyzoa.

Fenestella, sp.

Hydrozoa.

Cyclophyllum, sp.

Plantæ.

Podozamites, sp., like P. distans.
Cyclopteris (?) (On same slab as a Fenestella Rootlets.)

279. *Three miles above Sonoma Station.*

Brachiopoda.

Spirifera acuticostata.

Polyzoa.

Fenestella, sp.

PELICAN CREEK.

280. *Head of creek near Mount Divlin.*

Cephalopoda.

Goniatites, sp. like G. Woodsii (de Koninck).

281. *Five miles north of Sonoma Station.*

Brachiopoda.

Productus Clarkei.
„ cora.

282. *Three quarters of a mile above Sonoma Road Crossing.*

Lamellibranchiata.

Pecten asiaticus.
Edmondia (?), sp.
Panopaea, sp.

Brachiopoda.

Streptorhynchus crenistria, Phillips
Productus Clarkei.

Plantæ.

Silicified coniferous wood
Rootlets.

283. *Half-a-mile above Sonoma Road Crossing.*

Lamellibranchiata.

Edmondia (?) sp.
Panopaea, sp.

Brachiopoda.

Productus cora.

Hydrozoa.

A coral, undet.

Plantæ.

Rootlets.

284. *Half-mile below mouth of Coral Creek.*

Lamellibranchiata.

Edmondia (?), sp.

Hydrozoa.

Cyclophyllum, sp.

285. *One hundred yards below last-named locality.*
Rootlets.

286. *One mile below Coral Creek.*
Rootlets.

287. *At mouth of gully above Palmer's old station.*
Rootlets.

288. *Opposite Palmer's old station.*

Lamellibranchiata.

Panopaea, sp.

Brachiopoda.

Productus Clarkei
Spirifer, sp.

Polyzoa.

Fenestella, sp.

289. *Two hundred yards below Palmer's old station.*

Brachiopoda.

Productus Clarkei (Eth.)

Plantæ.

Rootlets.

290. *One mile below mouth of Two-mile Creek.*

Brachiopoda.

Productus Clarkei.

291. *Argillaceous sandstone below Kennedy Coal Seam.*
Rootlets.

292. *Cliff at outcrop of Garrick Coal Seam.*

Lamellibranchiata.

Mya or Homomya, sp.
Edmondia, sp.
Panopæa, sp.

Plantæ.

Rootlets.

293. *Above coal seam (carbonaceous shale) at No. 7 Traverse Station.*

Brachiopoda.

Streptorhynchus crenistria (*Teste* Daintree, Quart. Jour. Geol. Soc. Lond., XXVIII., p. 287.)

294. *Next cliff below No. 7 Traverse Station.*

Plantæ.

Glossopteris (*Teste* Daintree, loc. cit.)

PARROT CREEK.

295. *One mile above mouth of Cockatoo Creek.*

Hydrozoa.

Cyclophyllum, sp.

296. *N.E. flank of little Pophyry Range on W. side of creek, three miles up.*

Brachiopoda.

Productus Clarkei.

297. *Four and a-quarter miles up creek.*

Brachiopoda.

Productus Clarkei
,, cora
Spirifera glabra
,, verpertilio
,, acuticostata.

Polyzoa.

Fenestella, sp.

Hydrozoa.

Cyathophyllum, sp.

298. *Quarter of a mile above last-named locality.*

Brachiopoda.

Productus cora.

Plantæ.

Rootlets.

299. *One*

299. *One mile above last locality.*

Polyzoa.

Fenestella (same species as in Coral Creek).

300. *Eight miles up the creek.*

Brachiopoda.

Productus Clarkei.
" scabriculus.
Streptorhynchus crenistria.

Polyzoa.

Fenestella (same species as in Coral Creek).

Plantæ.

Rootlets.

301. *Nine and a-half miles up the creek.*

Brachiopoda.

Productus Clarkei.
Streptorhynchus crenistria.

302. *Four hundred yards higher up the creek.*

Brachiopoda.

Productus Clarkei.

III.—UPPER (MAINLY FRESHWATER) SERIES.

303. *Jack's Creek* (above Macarthur Coal Seam).

Reptilia.

A femur, sp. undet.

Plantæ.

Coniferous wood (trunks and roots) silicified.

304. *Bottle-tree Ridge, on east side of Jack's Creek.*

Plantæ.

Coniferous wood, silicified.
Glossopteris Browniana, var. Australasica.

MACARTHUR CREEK.

305. *Shale below Macarthur Coal Seam.*

Plantæ.

Glossopteris Browniana, var. Australasica.
Sphenopteris.

BOWEN RIVER.

306. *Shales below the Daintree Coal Seam.*

Plantæ.

Phyllotheca Hookeri (McCoy).

COCKATOO CREEK.

307. *Three quarters of a mile up the creek.*

Plantæ.

Coniferous wood (silicified)
Glossopteris Browniana, var. Australasica.

308. *Three miles up the creek.*

Plantæ.

Glossopteris Browniana, var. Australasica.

309. *Eleven miles up the creek.*

Plantæ.

Glossopteris Browniana, var. Australasica.
Gangamopteris (?) (McCoy).
Coniferous wood, silicified.

310. *Twelve miles up the creek.*

Plantæ.

Glossopteris Browniana, var. Australasica.
Odontopteris (?)
Phyllotheca indica.

ROSELLA CREEK.

311. "Two miles above Havilah Paddock and Havilah-Byerwin road, one mile south of Rosella Creek crossing" (same bed). (A marine bed intercalated with the freshwater series.)

Cephalopoda.

Goniatites, sp. Like G. Woodsii (same species at head of Pelican Creek).

Gasteropoda.

A cast. Sp. undet.

Brachiopoda.

Productus cora
,, scabricalus
Spirifer, sp.
Streptorhynchus crenistria.

312. *Quarter-mile west of creek, in road from Havilah to Biralee.*
Coniferous wood, silicified.

313. *Between third and second Traverse Stations.*
Silicified coniferous wood.
Carbonised plant-remains.

RUDOLPH CREEK.

314. *Two miles below road crossing.*
Glossopteris Browniana, var. Australasica.

315. The following table sums up the fossil above given :—

I.—LOWER SERIES.

No fossils.

II.—MIDDLE OR MARINE SERIES.

Cephalopoda.

Goniatites Woodsii (de Koninck).

Gasteropoda.

Casts, undet.

Lamellibranchiata.

Pecten asiaticus (de Koninck).
Myacetes, sp.
Panopaea salcata
Edmondia (?) ; a gigantic species
Mytillus ; like M. cinctus
Mya or Homomya.

Brachiopoda.

Productus Clarkei.
,, scabriculus.
Productus longispinus.
,, cora.
Spirifera glabra, Martin.
,, acuticostata, de Koninck.
,, vespertilio, Sowerby.
Streptorhynchus Davidsoni (Etheridge).
,, crenistria.

Polyzoa.

Fenestella.

Hydrozoa.

Cyclophyllum, sp.
Cyathophyllum.

Plantæ.

Silicified coniferous wood.
Glossopteris (Teste, Daintree).
Rootlets.

316. UPPER (MAINLY FRESHWATER) SERIES.

Reptilia.

A femur.

Cephalopoda.

Goniatites Woodsii, de Koninck.
(Same species occurs in middle series).

Gasteropoda.

A cast, sp. undetermined.

Brachiopoda

Brachiopoda.

Productus cora (occurs also in middle series).
„ scabriculus „ „
Streptorhynchus crenistria „
Spirifer, sp

Plantæ.

Silicified coniferous wood.
Glossopteris Browniana, var. australasica.
Sphenopteris (?)
Phyllotheca indica (Bunbury) (P. Hookeri, McCoy).
Gangamopteris (?)
Odontopteris (?)

317. The same species of drifted coniferous wood is common to the marine and the freshwater series. *Glossopteris*, so abundant in the freshwater series, has also, according to Mr. Daintree, been detected in the marine series. I have not been able to verify this observation, although I have no doubt whatever of its accuracy.

318. In the marine series the characteristic fossil is that named by Mr. Etheridge *Productus Clarkei*. *Glossopteris Browniana var. australasica*, *Phyllotheca indica*, and a species of coniferous wood, characterise the freshwater series throughout.

319. The fact that during the deposition of the upper series, the freshwater conditions were for a time locally suspended, and marine conditions again set in, to which we owe the deposition of the beds at the Rosella Creek crossing of the Havilah-Byerwin road, is of the utmost importance, as proving that the marine fauna of the lower formation lived on side-by-side with the land-plants of the upper. Every one of the mollusca of the Havilah-Byerwin marine beds occurs in the underlying marine series.

320. There is no stratigraphical any more than there is palæontological evidence that an unconformity—a great gap in time—divides the marine from the freshwater deposits in the Bowen River Coalfield. I have no hesitation in regarding the two series, as well as the traps of the Toussaint and Macedon Ranges, and the underlying sandstone, as forming an unbroken record of the whole of the time from the deposition of the lowest to that of the highest bed.

321. The time represented in this region by the outbursts of lava and ash forming the trappean ranges, was occupied over a wide area (Star, Mount Wyatt, Avon River, Gippsland, &c.) in the deposition of stratified rocks containing *Lepidodendron australe*, McCoy (=*L. nothum*, Unger, according to Carruthers), *Leptophlaeum*, *Producti*, *Spiriferæ*, &c., but without coal seams. On palæontological grounds Mr. Etheridge refers the strata containing these fossils to the age of the Devonian of Europe and Canada;* while Prof. McCoy refers the Lepidodendron beds to the Carboniferous epoch.†

322. According to the Rev. W. B. Clarke, the Lepidodendron beds are succeeded unconformably at the head of the Don River (a tributary of the Dawson) by the coal measures of the Dawson River.

323. This order of succession is disputed by no one; but upon the age of the Australian coal measures, palæontologists are not agreed. Prof. McCoy maintains that they are of oolitic date, on account of the occurrence of *Glossopteris*, whose affinities he says are entirely oolitic. The Rev. W. B. Clarke, on the other hand, maintained that not only was the oolitic age of *Glossopteris* a mere assumption, but also that, as a matter of fact, the strata containing it in New South Wales are interpolated among strata containing marine fossils of carboniferous types. The latter fact has since been confirmed by other observers.

324. Mr. Chas. S. Wilkinson, Government Geologist for New South Wales, commenting on a collection of fossils from the lower marine beds of New South Wales, exhibited at the Metropolitan Intercolonial Exhibition of 1875, says‡—

325. "This suite of fossils is specially interesting, as showing not only the range through the coal measures of the Glossopteris and Phyllotheca plants, so abundant in the upper coal measures of Woolongong, Lithgow Valley, and Newcastle, but also the association of those plants with the marine fauna of the lower coal measures; thus affording evidence agreeing with that of the previously mentioned fishes, as to the upper Palæozoic age of the New South Wales coal measures."

326. Mr. John Mackenzie, Examiner of Coalfields, in a valuable "Supplementary Report on the Coalfields of New South Wales" (1875), gives numerous instances where beds associated with the coal seams and containing *Glossopteris* are overlaid by strata containing a carboniferous fauna.

327. Mr. Daintree, in 1863, saw at Stony Creek, N.S.W., palæozoic marine fossils overlying coal seams with *Glossopteris*.

328. He also records two instances of *Glossopteris* in the middle (marine) series of the Broken River District. Quart. Journ. Geo. Soc. Lond., XXVIII., pp. 286 and 288.

329. Although I was not able to detect the plant in so low an horizon, the marine beds on the Havilah-Byerwin road, intercalated among the strata of the freshwater series, were found to contain carboniferous mollusca, and are superior in position to a very considerable thickness of freshwater strata crammed with *Glossopteris*.

330. *Lepidodendron* and encrinites are conspicuous by their absence from the Bowen River Coalfield.

331. Of the above list of fossils, it may be said generally that the great majority of the mollusca indicate an upper Palæozoic (Carboniferous) age, while a few are of Devonian types, and one at least has hitherto been regarded as cretaceous. The fossil plants would appear to indicate a Mesozoic age.

332. In

* Quart. Journ. Geol. Soc., Lond., XXXVIII., p. 324.
† Prodromus of the Palæontology of Victoria. Decade I., p. 37.
‡ Mines and Mineral Statistics of New South Wales, 1875, p. 132.

332. In spite of this apparent contradiction, it is undoubtedly true that both the flora and fauna belong to one and the same great period. That this period was exactly coincident with the carboniferous of Europe and America, is, considering the great distance, very unlikely. The Queensland coal measures may, however, fairly be considered to represent homotaxially the European and Amerian carboniferous formation, *i. e.*, the Queensland region was, during the deposition of its coal measures, inhabited by animals most nearly representing, and in some cases identical with the animals inhabiting the European and American area during the deposition of the typical carboniferous formations. That the land surfaces of the two regions were covered with incongruous floras at the time when the faunas were homotaxially related, is not very surprising.

333. One lesson taught by the fossil collections now made will probably be the much greater range than has hitherto been known of certain animals and plants of restricted range in the typical European formations. A similar fact in the fossils of the Indian carboniferous rocks struck Mr. Thos. Davidson, who observes (Quart. Journ. Geol. Soc. Lond., XVIII., p. 27):—"Two of the species of Terebratata have puzzled me much, and raised some doubt in my mind as to their age; for they remind me more of what we should expect in the jurassic or even cretaceous than in carboniferous strata." The discussion of this question had better, however, be postponed till a thorough examination of the collection has been made.

334. The point of greatest practical importance in regard to the palaeontology of the coalfield is the connection established between the Queensland Coalfield and that of Newcastle, N.S.W. I think it can no longer be doubted that our upper, or freshwater, series is identical with the upper coal measures of the sister colony, which are characterised by silicified coniferous wood, *Glossopteris*, and *Phyllotheca* (see Wilkinson's "Mines and Mineral Statistics 1875," p. 129). The coal measures of the two colonies may be compared as follows—adopting for New South Wales the table given by Mr. Wilkinson:—

New South Wales.	*Queensland.*
Wianamatta series; Hawkesbury series.	
Upper coal measures (Newcastle, Wollongong, and Bowenfels beds).	Upper freshwater series of Bowen River, &c.
Upper marine beds; lower coal measures; lower marine beds.	Middle marine series of Bowen, Dawson, &c.
Lepidodendron beds.	Bedded traps. Lower sandstones.

335. The correlation of the New South Wales coal measures with those of India has for a long time puzzled geologists. It is needless here to follow the discussion, which presented many difficulties that were only explained on the detailed mapping of the country by the geological survey. Suffice it to say that Dr. Oldham, the late director of the survey, pronounced his conviction* that the Damuda group of the Indian Coalfield was the equivalent of the Wollongong sandstone, and that on the double ground of the agreement of their plant remains and the similarity of the lithological character and structure of the Talchir group and the Wollongong sandstone. Dr. Oldham regarded the Damuda group as representing part, if not the whole of the Permian system, and a large part of the carboniferous epoch of Europe.

336. In a review of the present state of the question, Mr. Henry W. Blandford† comments as follows (p. 528) on Dr. Oldham's conclusions:—"I should myself be disposed to concur in this conclusion were it not for the evidence of glacial action afforded by the oldest deposits of the Talchir group, which taken in conjuction with Professor Ramsay's discovery of the glacial character of the Lower Permian breccias, irresistibly suggests the contemporaneity of the two formations.

337. "At the base of the Talchir group, wherever these rocks have been met with, occurs that remarkable boulder-bed first noticed in Talchir, and described in the 1st volume of the 'Memoirs of the Geological Survey.' Its character appears to be very constant. It consists of blocks of all sizes up to 42 feet in circumference, imbedded in a fine silty (sometimes sandy) matrix, often of a green colour and finely stratified. The blocks have in some cases certainly been transported from a distance of some miles; but this is not in general easy to ascertain, as the older rocks are frequently of very uniform character over large areas. When this bed was first described (in Talchir) in 1856, Mr. W. T. Blanford suggested its glacial origin and the transport of the boulders by ice, seeing that any movement of water sufficiently violent to disturb the imbedded boulders must infallibly have swept away the fine silty matrix. He further suggested the agency of ground ice, and ventured to predict that further examination would probably end in the discovery of groovings and scratchings on these surfaces. This view of the origin of the boulder bed for many years found but little favour; but in 1872, Dr. Oldham and Mr. Fedden exhumed from the bed, in the neighbourhood of the Godavery, 'large masses of foreign or transported rocks, the surface of which was polished as perfectly as marble by a lapidary; this polished surface being beautifully scored and furrowed in parellel and straight lines, precisely similar to the scoring, furrowing, and polishing which rocks carried down by glaciers and ground ice are so well known to exhibit. And, further, the hard Vindhyan limestone, on which this Talchir boulder bed was laid, was also found to be scored in long parallel lines wherever the upper surface was freshly exposed by the recent removal of the overlying rocks.' One of these exhumed boulders is now in the Geological Museum of Calcutta; and I think that an inspection of it would convince the most sceptical of its glacial character.

338. "No similar bed has been described in Australia, where the beds overlying the coal are of marine origin; but the Karoo formation of South Africa, which resembles the Indian Dámúdá series in containing *Glossopteris* and *Phyllotheca*, has at its base a bed termed the 'claystone porphyry,' by Bain; the 'Trap-Breccia,' by Wyley; the characters of which evidently closely resemble that of the Talchir 'boulder bed.' The resemblance has already been pointed out by Mr. Griesbach; but he has fallen into the error of confounding the Talchir boulder bed with that one which occurs at the base of the Trichinopoly

* Memoirs of the Geological Survey of India, III., p. 207.

† On the Age and Co-relations of the Plant-bearing Series of India, and the Former Existence of an Indo-Oceanic Continent. Dec., 1874., Quart. Journ. Geol. Soc. Lond., XXXI., p. 519.

poly Rájmahál) plant-beds, which differ from the former in lithological character, and is probably an ordinary court-conglomerate. The Karoo boulder bed, according to Dr. Sutherland, is not, as supposed by its earlier describers, a volcanic breccia, but affords distinct evidence of its glacial origin."

339. Regarding the Australian Coal Measures, I am not aware that boulder beds had been observed previous to my late trip. From the preceding pages it will be seen that both the upper or freshwater group and the middle or marine group are marked throughout by travelled boulders and groups of boulders, which I do not hesitate to ascribe to ice action, although none of the boulders were observed to be striated. I cannot, however, agree with Mr. Blanford in regarding the occurrence of boulder beds as by itself any strong confirmation of the supposed contemporaneity of the Talchir and Karoo groups and the Permian deposits of Europe, since the glacial conditions are just as likely to have obtained in the Carboniferous as in the Permian era.

340. A question of the deepest interest to Queensland is the possible extension of the coal measures westward. The whole of the western interior is covered, at least on our geological maps, with secondary and tertiary deposits. But the thickness of these deposits has yet to be ascertained; and whether or not they conceal carboniferous rocks is another question. I am even prepared to find that the fossil contents of the western strata have in some cases led the early observers too hastily to the conclusion that they were among mesozoic rocks—the great vertical range of some of the fossils not having been suspected. It need surprise no one if the boring operations for water in the western districts undertaken by the Government should reveal the fact that the strata appearing at the surface over large areas are not mesozoic nor cainzoic, but either *are* or *cover* carboniferous rocks. Coal seams have recently been discovered at a depth of 150 feet at Vindex Station, on the Western River, but I have not yet heard anything to throw light on the geological bearings of the discovery. The subject requires close investigation. For anything we at present know, the western plains may turn out to be one vast coalfield, covered more or less deeply with newer rocks, and with a few ridges and islands of older palæozoic rocks—which are goldfields.

QUALITY AND ECONOMIC VALUE OF THE COAL SEAMS.

341. *Kennedy Seam.*—Made up of fine laminæ, of varying purity and lustre, some of the laminæ being mere carbonaceous clay and others good coal. Burned with difficulty in a strong wood fire, the result, in scarcely diminished bulk, being a reddish shaley ash. Splits readily along the planes of bedding, and at right angles to these in numerous joints. Very friable. Does not take a polish under the knife, but breaks up into minute cubes. Powder, ink-black.

ANALYSIS.

Water		1·12
Volatile hydrocarbons		41·81
Fixed carbon	a bright hard coke, 57·07 per cent.	42·79
Ash (light-brown)		14·28
		100·00

Specific gravity, 1·463.

GARRICK SEAM.

342. Layers of shining coal alternating with layers of dark coaly shale. Required a strong wood fire to keep it burning, and left a good deal of brown ash. Joints coated with sulphur and alum. Moderately firm. Takes a feeble polish under the knife, with a deep black lustre. Powder, lamp-black.

ANALYSIS.

Water		1·23
Volatile hydrocarbons		35·25
Fixed carbon	a bright hard coke—63·529	46·60
Ash (grey)		16·92
		100·00

Specific gravity, 1·456.

343. Near the bottom of the seam, a light, feebly lustrous, non-soiling coal occurs in nodules of 3 or 4 inches in diameter. These burn well. It would appear that in the formation of these concretions, some of the earthy impurities have been rejected.

ANALYSIS.

Water		0·99
Volatile hydrocarbons		19·89
Fixed carbon	spongy coke, very hard—79·12 ...	67·58
Ash		11·54
		100·00

Specific gravity, 1·402.

On following the Garrick seam from E. to W., it becomes broken up by one and sometimes two layers of hard ferruginous coal, exhibiting a tendency to columnar structure.

MACARTHUR SEAM.

344. Where its outcrop is seen, both on Jack's Creek and Macarthur Creek, this scam is accompanied by a sheet of dolerite, which has rendered it smutty and almost useless throughout. The portions which are somewhat better are too thin to be practically workable. Mr. A. Macarthur made vigorous attempts

attempts to obtain samples of this coal in its purity, as far from the outcrop as possible, by driving into the bank of Macarthur's Creek, but had to throw away 7 tons of "small and broken mineral" in getting two tons of the coal. In other words, he only obtained the latter quantity by severe "picking." A specimen was sent to Mr. A. C. Gregory, who reported as follows:—

345. "The specimen appears to be injured by weather, and the coal will probably improve at a greater depth.

Volatile in coking	28·8
Fixed carbon	38·6
Ash	32·6
	100·0

Specific gravity, 1·67.

"The percentage of ash is so high that the coal would be little value unless by a careful selection from the best parts of the seam, the proportion of ash should be lessened."

346. Mr. R. Archibald, Colliery Manager, Ipswich, reported on another sample: "It is of little or no value, the greater part being stone."

347. Having seen the coal *in situ*, I can only concur in the practical and scientific opinions expressed by Mr. Archibald and Mr. Gregory. The seam, where its outcrop is visible, is worthless.

DAINTREE SEAM.

(For section of this seam see par. 190.)

348. A sheet of intrusive dolerite rests on this seam where its outcrop is visible in the left bank of the Bowen River. The lower part of the dolerite has been converted into "white trap." The topmost 6 feet of the coal have been destroyed by the trap, which wanders through it in veins and "pockets," renders it columnar, and converts it partly into a kind of stony coke and partly into an earthy graphite. Seven feet of the underlying coal are less injured, and a three-inch band near the bottom presents no visible sign of having suffered from the heat radiated from the intrusive igneous rock.

The 3-inch band above referred to (*a* in par. 190) is jet-black and lustrous, with some duller laminæ. Polishes under the knife. The powder has a lead-black hue. Has a tendency to break up in right rhombic prisms, and is rather brittle in consequence (at least at the weathered outcrop). Has reticulating films of carbonate of lime in joints.

Analysis:

Water		1·91
Volatile hydrocarbons		20·02
Fixed carbon	coke, 78·07	63·60
Ash (white)		14·47
		100·00

The coke is tender, and swells more along some laminæ than others.

Specific gravity, 1·453.

The seam (7 feet thick) of the coal (*b* in par. 190) overlying the band last above referred to, is light brownish-black. Has a laminated structure, some of the layers being rather carbonaceous shale than coal. The purer layers tend to split up in right rectangular prisms, but are otherwise very firm. Takes a fine brownish-black polish. Powder, lamp-black.

The upper part of this seam appears to be more homogeneous than the lower. The laminated structure is equally distinct in both, but the lower appears to be more broken up by shaley partings. This supposition is borne out by the analysis.

Analysis of *Top* of Seam. (*b* in par. 190.)

Water	2·41
Volatile hydrocarbons	15·72
Fixed carbon	57·40
Ash	24·44
	100·00

Specific gravity, 1·42.

Analysis of *Bottom* of Seam. (*b* in par. 190.)

Water	2·50
Volitile hydrocarbons	13·09
Fixed carbon	57·14
Ash	27·27
	100·00

Specific gravity, 1·513.

The 6-inch seam (*d* in par. 190) above that last described is amorphous, like a mass of consolidated coal-dust. Feebly lustrous on points of surface. Soft portions dug into with the knife or hammer take a bright black-lead lustre. It is in fact a sort of very earthy black-lead. Occasional fragments of silky vegetable charcoal occur in it. Powder, lamp-black. It is interesting as showing one of the stages in the alteration produced by the intrusive rock.

Analysis.

Water	2·91
Volatile hydrocarbons	9·96
Fixed carbon	49·63
Ash	37·50
	100·00

Specific gravity, 1·551.

The

The uppermost visible portion of the Daintree seam (43 inches in thickness) is in almost immediate contact with the overlying dolerite, and has consequently suffered the extreme effects of the heat. It has been rendered columnar throughout, the columns having a transverse section of from half an inch to three inches in diameter. The coal has been converted into a hard stony coke. It brightens under the knife to a pale black-lead lustre. Its powder is ink-black.

ANALYSIS.

Water	2·14
Volatile hydrocarbons	7·98
Fixed carbon	51·79
Ash	38·09
	100·00

Specific gravity, 1·779.

349. From the detailed sections above given it will be seen that there are numerous seams of coal besides those above referred to, within the limits of the field, but that they are either too thin to work, or if of workable thickness, have been hopelessly destroyed by the intrusion of igneous rocks.

350. To facilitate the comparison of the various coal seams analysed, with one another, and with seams from other localities, the above analyses are thrown into tabular form:—

Name of Seam.	Sp. Gr.	Water.	Volatile Hydrocarbons.	Total Volatile.	Fixed Carbon.	Ash.
Kennedy seam	1·463	1·12	41·81	...	42·79	14·28
Garrick seam	1·456	1·23	35·25	...	46·60	16·92
„ nodulous part	1·402	0·99	19·89	...	67·58	11·54
Macarthur seam (Mr. Gregory's analysis) ...	1· 67	...	...	28·8	38· 6	32· 6
Daintree seam, 3 in. band (a)	1·453	1·91	20·02	...	63· 6	14·47
„ top of 7ft seam (b)	1· 42	2·44	15·72	...	57· 4	24·44
„ bottom of ditto (b)	1·513	2· 5	13·09	...	57·14	27·27
„ 6-inch seam (d)	1·551	2·91	9·96	...	49·63	37·50
„ coked upper, 43 ins.	1·779	2·14	7·98	...	51·79	38·09

351. We may assume for the present that the Kennedy and Garrick seams, and the 3-inch band of the Daintree seam are fair examples of the normal or unaltered condition of the coals of this field. One characteristic common to all is the very large proportion of earthy matter, yielding from 11·5 to 16·9 per cent. of ash. In good coals the proportion is rarely more than 6 per cent.

352. The proportion of fixed carbon in the nodular part of the Garrick and the 3-inch and 7-foot bands of the Daintree seam is quite up to, if not over the average in the workable seams of New South Wales. The seams in question are suitable for steam and metallurgical purposes, although the amount of ash would be a practical difficulty. The fixed carbon in the best anthracites amounts to over 90 per cent. The evaporating power of coals bears a direct ratio to the amount of fixed carbon.

353. Picked samples of the Kennedy seam are rich in volatile hydrocarbons, and might serve for gas-making or for household use.

354. The Garrick seam (with the exception of the nodular part, which is better) is a fair average "bituminous" coal, although containing too much ash. It appears, however, to contain a good deal of sulphur, which would unfit it for most purposes.

355. With regard to the low proportion of volatile hydrocarbons characteristic of the whole series, it is quite possible that every coal seam in the field may have been robbed of more or less of its gaseous components by destructive distillation, owing to the heat radiated from the masses of igneous rocks injected at intervals among the strata. It will be observed from the tables that the seams in contact with the dolerite sheets have very little volatile matter left—as low as 7·98 per cent. in one case.

356. But to whatever cause the poverty in hydrocarbons may be due, the greater facilities for the escape of volatile matter at the outcrops of the seams would lead us to expect that the unweathered portions will be richer in gasses than the weathered portions near the outcrop. This is almost always found to be the case in other coalfields.

357. Closely connected with the poverty in volatile matter observed at the outcrop of the seams is the richness of those portions in ash. This connection will be seen if we compare, for example, the 3-inch band of the Daintree seam with the No. 2 seam of Wallerawang, analysed by Professor Liversidge*:—

	Water.	Volatile Hydrocarbons.	Fixed Carbon.	Ash.
Daintree 3-inch band	1·91	20·02	63· 6	14·47
Wallerawang No. 2 seam	1·95	27·25	61·86	8·94

Let

* Trans. Roy. Soc. N.S.W., VII. (1874).

Let us suppose that the Daintree, like the Wallerawang seam, originally had 27 per cent. of volatile hydrocarbons, but lost 7 per cent. owing to the intrusion of the dolerite. By restoring the lost 7 per cent. the absolute quantity of ash would only amount to 13·52 per cent. of the whole, instead of 14·47. If, on sinking or driving into a coal seam, the amount of volatile hydrocarbons should be found to increase away from the outcrop (and I believe this will be notably the case in the present instance), the ash must proportionally decrease.

358. Owing to the disturbance of the strata of the coalfield from their original horizontality, and their subsequent denudation, *every stratum is bound to make its appearance at the surface*. Some conception of the structure of the coalfield may be conveyed by representing by a number of saucers "cased," *i. e.* placed one within the other, and with their rims ground down to a uniform level, the various strata, whether of coal, shale, sandstone, or ironstone. The outcrops of the seams would be represented by the rims of the saucers. If the surface were entirely stripped of its soil there would be no need for boring, as all the coal seams would be visible at the outcrop. But as this is not the case we must be content to view what the rivers and gullies here and there have laid bare for our inspection, together with such rocks as stand up above the soil by virtue of their superior hardness. The Bowen River and numerous tributary creeks have furnished us with a view of what must be a considerable proportion of the strata of the coalfield, but certainly not all.

359. In a country formed by the alternate outcrops of harder and softer rocks, the natural tendency is for the harder to present themselves as ledges and cliffs, while the softer decompose, often for considerable depths into the soil or "drift." The softer strata thus frequently escape observation; and coal seams belong peculiarly to this class.

360. But many of the Bowen River coal seams are exposed, and most of those exposed are bad. This obvious objection, which at first sight appears to condemn the field, is not so conclusive as it seems. The appearance at the surface of the worthless coal seams is due to the circumstance to which they owe their ruin, viz., the presence of a sheet of intrusive igneous rock, of great hardness. So much was this found to be the case that I soon learned, on discovering a coal seam, to look out for the accompanying dolerite, and *vice versa*. The dolerite sheets are not only hard themselves, but they harden the coal seams with which they come in contact, and consequently give rise to cliffs on the land, and waterfalls in the rivers and creeks. Coal seams *not* accompanied by the destroying dolerite have not a tithe of the chance enjoyed by the burnt seams, of making visible outcrops.

361. With regard to the phenomena attending the burning of coal seams by dolerite or basaltic igneous rocks, and the reaction of the carbonaceous rocks on the latter, interesting observations are recorded by Mr. J. B. Jukes from South Staffordshire (Memoir on the Geology of the South Staffordshire Coalfield); by Mr. James Geikie from Lanarkshire and Ayrshire (Memoirs of the Geological Survey of Scotland. Explanations of sheets 22 and 23); by Prof. A. Geikie, from Ayrshire (Mem. Geol. Survey of Scotland. Explanations of sheets 14 and 22); and by Mr. B. N. Peach, from Lugar and Sanquhar (Mem. Geol. Survey of Scotland. Explanation of sheet 15).

362. It may be supposed that masses of igneous rocks forcing their way upwards among slightly inclined stratified deposits would intrude into *all* lines of weakness, including all the seams of coal. But in practice it has been found that the intrusive rocks are most capricious in their action, often failing to take advantage of the most obvious weaknesses in the crust of the earth. In the British coalfields, for instance, it is only a seam here and there that has been burnt or rendered blind, *i.e.*, having lost the greater part of its volatile components. I know cases in Ayrshire where a "burnt" seam, accompanied by the destroying dolerite, lies between two other seams not sensibly affected; and others in which the dolerite escapes from the plane of the coal seam into strata where its presence is of no consequence to the miner. It may safely be averred, that *no* instance is known of an extensive coalfield with numerous seams, where even a large proportion of the available coal is destroyed by intrusive igneous rocks.

363. The New South Wales Coalfield itself affords an instance of the intrusion of doleritic rocks, according to the Rev. W. B. Clarke, who mentions (Quart. Journ. Geol. Soc., Lond., IV., p. 62), "an altered sandstone at Arowa, near Arrawang, on Williams' River, where the carboniferous series rests upon porphyry, and has been intruded into by greenstone and trachytic basalt."

364. In the detailed sections mention is made of some thin seams of oil shale. These when tested in the laboratory gave very disappointing results, as they proved to contain on an average as much as one-half of earthy impurities, and less than 14 per cent. of hydrocarbons.

365. Several seams of good *ironstone*, but none of workable thickness, were observed in the upper or freshwater division of the measures. There are also in the marine division many ironstone seams, but of a quality too poor for use, being just on the uncertain boundary-line which divides ferruginous sandstone from arenaceous ironstone.

366. The *alum shales* of Parrot and Cockatoo Creeks, are at least as good as those from which alum has been manufactured in Scotland for more than a century. A sufficient demand for alum as a mordant in dyeing may possibly arise with the spread of colonial woollen manufactures.

367. For the purpose of "proving" the coalfield, I should recommend, in the first place, a deep bore (say 1,000 or 1,200 feet), commencing near the uppermost bed of the basin. The most suitable place for this bore would be along the axial line of the synclinal trough which runs parallel to the river on its
No. 1 Bore Site. south side. A site about one mile west of the north-west corner of Rudolph block would be in a favourable position, and have the advantage of being accessible by the Havilah-Byerwin road. This place is 78 miles from Bowen, by Eurie Hotel, Mount Pleasant, Sonoma, and Jack's Creek. A bore in this position may be expected to give a complete section of the upper or freshwater series, and to reveal such of the coal seams as do not show at the surface owing to the deepness of the soil and drift. It would also test the presence or absence of workable seams of ironstone, oil shale, or alum shale.

368. This bore should, if at all practicable, be continued down to the marine series, at a depth which I estimate at 900 feet. If, however, the top of that series should be found to lie too deep, another
No. 2 Bore Site. bore might be put down towards the rise of the beds, say on the side of the Havilah-Biralee road, three miles west of the Rossella Creek crossing, and carried through the upper and as far as convenient into the middle series. A bore in this locality would, I estimate, reach the top of the marine series at a depth of about 300 feet.

369. Should

369. Should the top of the marine series have been reached in the first bore, and the second be on that account unnecessary, I should recommend that for proving the *marine series*, a bore be sunk through the outcrop of the Daintree seam. This seam, near the base of the upper series, would give a recognisable datum line, and would connect the upper with the middle division of the coalfield. **No. 3 Bore Site**

370. I apprehend that the thickness of the marine division is too great to be pierced in one bore. I doubt, besides, whether this series carries coal seams either in number or thickness equal to the fresh-water series. Unless, therefore, the last-mentioned bore should give very encouraging results, I should not recommend in the meantime further outlay in prospecting, except for —— **No. 4 Bore Site.**

371. A bore through the outcrops of the Kennedy and Garrick seams (62 miles from Bowen by Sonoma and Mount Pleasant.) This bore would at least prove the condition of these seams at a distance from their outcrops, and might be continued to the top of the bedded traps, in the hope of finding the representatives of the "lower coal measures" of the New South Wales field.

372. The opening up of a coalfield in the North would react beneficially on every industry in the colony. A result of this magnitude cannot be left entirely to the precarious chances of private speculation. The placing of one of the diamond drills recently purchased by the Government, on the coalfield in question, would be a boon to the whole of Queensland. It is far from desirable that a Government should usurp the functions of the capitalist in mining or other enterprises; but in the present case the legitimate task of the capitalist would be to apply to the portions of the field lying nearer the coast, the knowledge gained from the standard borings.

373. One aspect of the question remains to be pointed out. The carriage of goods by dray from Bowen to the river costs about £6 per ton. The tenth part of this freight would be quite prohibitive of the working of coal. But with a railway the cost of carriage would probably be less than 1d. per mile per ton, say about 6s. per ton.

374. No capitalist would be likely to undertake the preliminary boring at his own cost, knowing that he could not sell a single ton of the coal at the coast without first building 60 or 70 miles of railway.

375. Whether or not the Government see their way to undertake the preliminary boring operations above recommended, it is my duty to point out that the contemplated railway from Bowen to the interior ought, if possible, to pass through the coalfield. The route by which the preliminary survey of the railway is now being carried out ignores the coalfield altogether, passing by its northern end in the line of the Bowen Downs road. It must cross the Aberdeen and Herbert Ranges by gaps which no engineering can make easy, and in doing so will throw away for years, perhaps for ever, the hope that the railway and the coalfield will be of mutual benefit to each other.

The bridle-path from Sonoma to Bowen leads, by the valley of Pelican Creek, gradually up to a low pass in the Clarke Range. The pass offers no engineering difficulties worth mentioning, and a very gradual slope on the north side of the range takes the road down to Port Denison. A railway by this route would be no longer (I believe shorter) than the one now being surveyed, and it would render the opening up of the coalfield at any time a possibility; while, if the borings should in the meantime have been carried out successfully, it would render it at once an accomplished fact.

APPENDIX A.

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APPENDIX B.

REPORTS OF THE BOWEN RIVER COAL ASSOCIATION.

G. F. Sandrock, Esq., Chairman of the Bowen River Coal Association.

Bowen, 1st October, 1875.

Sir,

I have much pleasure in reporting to you the safe return of our prospecting party, after, I think, a successful trip.

* * * * * * * * * *

I have now to report to you that I have found coal seams in the following localities:—

1st. I sunk a shaft on the right bank of Jack's Creek, and cut a seam 5 feet thick. The coal was in a decomposed state from being so near the surface, but moist. I dried some of it, and burned it at the camp fire. It burns a dull red.

2nd. I then put a shaft down on a small gully on the right bank of the Bowen River, and cut a seam of from 7 to 8 feet in thickness.

The coal in this shaft is of the same crumbling nature as in No. 1. Both these seams are horizontal, and range from 20 to 30 feet under the surface. They are one and the same, in my opinion. These two shafts are about a mile apart round by the creek.

We were at a great disadvantage for want of blasting tools and powder, as the seam in both these shafts is overlaid by from 10 to 20 feet of spirifer sandstone. So in this way we were obliged to sink always on the side of a hill, and could not come on coal under the rock.

I then traced the seam down the right bank of the Bowen River for some distance, and I think it continued to increase in dimensions.

Mr. Daintree in his Report mentions nothing about Jack's Creek.

3rd. We then got the party, after some trouble, across the Bowen, and on the left bank of a small creek without a name, about a mile from the Bowen, I discovered a 10-foot seam. I think this is the same as on Jack's Creek, only larger and firmer from the floods having cut away the cliff. This, I think, is the place where the coal is torn away from the bank, and strews the bed of the Bowen with large blocks of coal. One of these I burnt at our camp. I think it good furnace coal. I intended to have brought one of these blocks with me for your inspection, but was told that I could get plenty higher up the river. This, I afterwards found out, was not the case, so I missed bringing it.

4th. We then started for Rosella Creek, and two miles above Havilah Station found a horizontal coal seam, 10 feet in thickness, on the face of a white cliff nearly 100 feet in height [sample No. 4]. This coal won't burn. I attempted to drive behind the surface coal, but the cliff was in such a dangerous state I had to leave. I think this seam is the same as on Jack's Creek.

5th. I then made enquiries as to the "Branch Creek" of Mr. Daintree, but no one knew of such a creek. The manager of the station thought it might be Plum Creek, 15 miles to the south among the mountains, but he was not sure of there being coal on it.

Just as we were about starting for it, Mr. Wilson, one of the members of our association, came up to our camp, and stated that it *was* the creek, and that up at Byerwin Station the manager there had, in sinking a well, cut through a coal seam, and he, Mr. Wilson, had seen that coal burn.

6th. I now determined to return to the right bank of the Bowen, as all the information regarding "Branch Creek" was already in the hands of one of the association. This I did, and followed up the river to Beasley's old public-house and some miles above it. I found the fossils and indications most abundant, but not a trace of coal. I was disappointed at this, as I had been told by several parties that plenty of coal was to be found.

7th. We

7th. We next started for Pelican Creek by way of Sonoma Station. I prospected this creek for several miles both above and below the station. The fossils in the banks of this creek are most abundant: in one place the shells are 12 feet thick, in one layer, and some of the fossil trees are 12 feet long and 3 feet through. Yet notwithstanding all this, I could not find coal.

This was the last place I examined on my return to the port.

I may in conclusion state that in my opinion this 10-foot horizontal seam underlies the whole district on each side of the Bowen River, and is only under the surface from 20 to 40 feet.

8th. The road from the port to Jack's Creek is upon the whole a level one, save in crossing the Clarke and Herbert Ranges. There are four rivers to be bridged, as also several creeks.

The exact distance I am unable to give you, but I should say about 70 miles. This I think could be much shortened.

My report I have reduced as much as possible, and trust it may be satisfactory to the association.

I have, &c.,

A. MACARTHUR.

To the Chairman of the Bowen River Coal Association.

Bowen, 22 December, 1875.

Sir,

In obedience with the instructions I received from your committee, I sent the men rations and tools for the further prospecting of the coal seams of the Bowen River, on the 10th of last month, by a dray going to Byerwin Station; but owing to a break-down on the dray, they did not reach the ground so soon as I had hoped.

On their arrival, I sent them to work on a gully about a mile back from Jack's Creek, and after 20 feet sinking cut through the coal. It was, however, the same as the sample I brought down before, "soft and crumbling," and so I gave it up.

I then sent the men to work on a shaft on the hill between Jack's Creek and the gully above-mentioned. After 12 days' hard work, blasting from the very surface, they had only gone down 15 feet, and the rock harder than ever. At this point our fuse gave out, and I had most unwillingly to give this shaft up, as our gads were useless against such hard stone [A coarse-grained dolerite, R.L.J.]

The third shaft I got the men to sink was on a hill on Jack's Creek, and they cut the same soft coal as at the first shaft. I made them then drive from the shaft along the seam, but in 30 feet they never came on hard coal.

During the time the men were busy on these shafts, I employed myself looking over the various outcrops, and as there was only one dray likely to go down to the port for some months from the Upper Bowen, I determined to send you a sample of coal from the left bank of the Bowen River. I had found on my former trip an outcrop of 10 feet thick on the left bank. This I commenced driving on. and after several days' work came on hard coal. This, on taking home to the camp, I found burned without any flame or smoke. The colour of the fire was a dull red. Nothing put it out, as we had heavy thunderstorms during the time I was testing it, and the rain only caked the ashes on the top. The length of time it continued burning rather astonished me. One shovelful continued burning for upwards of 24 hours.

* * * Sent down half-a-bag of coal from the heap, on 8th Dec., 1875.

I intended to have taken the men to Pelican Creek for a couple of days, but found it quite impossible to get the tools, tents, &c., transported there. This I do not regret so much, as I had examined the ground Mr. Haylock had spoken to me about, and I found the outcrop all slate, and only a few inches of coal.

I trust that with the small sample of coal I have sent you down, you will be able to judge of the quality better than I could up there.

I have, &c.,

ALEXR. MACARTHUR.

Specimen of Coal from Bowen River.

This specimen appears to be injured by weather, and the coal will probably improve at a greater depth.

Sp. gr. ...	1·67
Volatile in coking	28·8
Fixed carbon ...	38·6
Ash ...	32·6
	100·

The percentage of ash is so high that the coal would be of little value unless by a careful selection from the best parts of the seam the proportion of ash should be decreased.

A. C. GREGORY.

Brisbane, 14th Feb., 1876.

[This was the Macarthur seam from Macarthur Creek.—R. L. J.]

Bowen, 22nd February, 1876.

J. Palmer, Esquire, Bowen.

Dear Sir,

I have much pleasure in reporting that notwithstanding the continued rain and the flooded state of the country I have got a load of over two tons of the coal across the Bowen River, and expect the waggon in town to-morrow or next day.

It was fortunate I went up to the district, as the coal formerly "grassed" was all swept away by the floods. It took me a good deal of hard work to get out more, as the drive was in a dangerous state from the wet.

If I could have taken out the coal by stripping along the hill I could have got much larger blocks, but it would have been wet, and would have weighed twice as much; but if I had put a pick into the side of the hill it would have come down in a body.

There is one satisfaction, that though the *bulk* of the coal bagged is small, it is as far into the hill as I have been able to get. In getting the two tons of coal I am sure I have thrown away seven tons of small and broken mineral.

I enclose a pen-and-ink sketch which may explain the trouble in driving, &c.

I am, &c.,

ALEX. MACARTHUR.

Ipswich,

Ipswich, 25th March, 1876.

R. W. Graham, Esquire.

Dear Sir,

Your letter came duly to hand on the 20th March, asking my opinion of the sample of Bowen coal you sent. I received it on the 23rd March. If it was a fair sample you sent, I am sorry to say it is little or no value, the greater part being stone. I have not the slightest doubt of there being better coal found in the district, as it is coal formation, so that there is always some encouragement. If you were to sink 4 or 5 feet further down, and get shale, you will probably get fern fossils. If it is a suitable place, I would recommend you to commence at the bottom of this seam, and either sink or bore the depth of 100 feet, for a fair trial; but it is very likely there would be coal found before going that depth. And if found, allow it to be examined by a practical man, as the party who selected the sample I received has known little about coal. If you write again, let me know what distance the seam is from town, and I will have great pleasure in giving you any information lying in my power.

I am, &c.,

R. ARCHIBALD.

Tralee Villa,
Bournemouth, April 16th, 1876.

John Palmer, Esq., Mayor of Bowen.

Dear Sir,

I am in receipt of your letter of 4th February, together with copy of report addressed to the Chairman of the Bowen River Coal Association, with reference to the Bowen River Coalfield.

It is satisfactory to learn that a seam of good hard coal has been discovered by Mr. Macarthur, and which in his opinion underlies much of the district on the Bowen River.

The action of bush fires and floods has so altered the original character of the coal outcrops in the whole of the Bowen River district, that sinking in the sound ground at some distance from the outcrop, is the only means of obtaining reliable results as to the quality and thickness of the seams; and this plan, Mr. Macarthur seems to have carried out most judiciously, as far as his time would allow.

In order, however, to be able to place before men of capital, a scheme involving a preliminary expenditure of, say a quarter of a million of money (for a light railway for 70 miles), it is essential to have more data—thickness and quality of coal already found; where situated; and markets for same when brought to the coast.

My impression is that the best method of obtaining a speedy development of the Bowen River Coalfield would be for your Association to urge the Government to have a complete geological survey made of that district, to be followed by a bore of 1,000 feet put down in the most advisable spot, to test the thickness, &c., of the various coal seams.

By this means all the data would be furnished for a company to make an offer to the Government to construct a railway from Bowen to a certain point on the coalfield, on certain conditions as to land grants, &c. Without these complete data, I fear such a project would never be entertained here.

I have been for the last three months so prostrated by illness as to have been quite unfit for business, and it will probably be several months before I can fully recover my health. If, however, you will send me a fair sample of the 10-foot seam, I will have it analysed and reported on, and give you any assistance in my power to effect the object you have in view, viz., the "opening up" of the Bowen River Coalfield.

Mr. Sutherland has frequently told me that in sinking wells on his old station in the Kennedy, he cut through two seams of good coal which he used for forge purposes.

It would be as well if your committee obtained samples of these, and particulars of thickness of seam, position, &c.

As I have resigned my position as Agent-General, if you wish to communicate further with me on this subject, my address will be "Holyrood House, Beckenham, Kent."

I am, &c.,

RICHARD DAINTREE.

By Authority: James C. Beal, Government Printer, William street, Brisbane.

7

1879.

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QUEENSLAND.

Robert L. Jack

REPORT TO THE HONOURABLE THE MINISTER FOR MINES ON THE NORMANBY AND MARENGO GOLDFIELDS. BY ROBERT L. JACK, GEOLOGICAL SURVEYOR FOR NORTHERN QUEENSLAND, 1879.

Presented to both Houses of Parliament by Command.

NORMANBY.

The Normanby Goldfield lies forty-one miles due south of Bowen. It is reached by a road which follows the valley of the Don to its source, a distance of forty-eight miles, and then crosses the heads of the Dart* (a tributary of the Broken River), for about three miles further.

The road presents no difficulties for the first forty-five miles, beyond being occasionally forced into the bed of the Don by the narrowing of the valley. At this point, however, some six miles from Normanby, the road and river issue from a narrow gorge. Above the gorge the track struggles for three miles over steep ridges and across deep gullies, through the middle of an amphitheatre hemmed in by the cliffs of the Clarke Range, whose southern lip it at last scales by a long sidling.

The summit of this cliff forms the watershed between the Don and the Dart, which latter stream empties itself, after a course of about twenty-five miles, into the Broken River, and thus contributes its quota to swell the waters of the Burdekin. In three miles more the road reaches Mr. John Campbell's paddock, the site of the now deserted township of Normanby.

From the summit of the sidling to the Broken River, the Clarke Range forms a gently-sloping tableland, deeply channelled by the Grant, Green Creek, and the Dart, and their numerous tributaries, which break up the tableland into minor ranges. Conspicuous among these are, the Grant Range, dividing the head-waters of the Grant and the Andromache; the Normanby, dividing the heads of Green Creek from the Grant; and the Dart, dividing the river of that name from Green Creek.

The Grant Range attains an altitude of from 1,700 to 2,000 feet above the sea-level. It trends to the north-west between Spring and Oakey Creeks (heads of Green Creek). From the head of Oakey Creek it runs south-south-west. The Bowen Road crosses it near its south-south-west extremity by a gap on the eastern side of Mount High.

The Clarke Tableland consists almost entirely of metamorphic rocks. That these have undergone metamorphism, followed by extensive denudation, prior to carboniferous times, is proved by the relations they bear to the coal measures of Pelican Creek and the Bowen River. There is much probability in favour of a pre-Devonian metamorphism; but in the absence of direct evidence, this must for the present remain an open question. Here and there, as in Jack's and Flagstone Creeks, shales, slates, quartzites, greywacke, Lydian-stone, and mica and hornblende schists are met with, having a still recognizable stratification, and there is little doubt that the whole range was originally composed of stratified rocks of similar character. In the immediate neighbourhood of Normanby, however, the occurrence of stratified rocks is notably rare. The northern edge of the tableland, including Mount Roundback, the Round Hill, and the Mamelon, consists of a well-marked white granite, occasionally passing into a syenite, the mica being either wholly or partially replaced by hornblende. Similar granite breaks out in isolated "tors" and cliffs on the north-eastern side of the Normanby Range. The Grant Range is also for the most part granitic.

The Normanby Range, on the other hand, consists almost entirely of tourmaline-porphyry, a ternary compound of quartz (for the most part amorphous), black mica (sparsely), and large or small crystals of black tourmaline (schorl). The whole rock is mixed up with minute crystals and streaks of iron pyrites, and streaks and veins of serpentine. Occasional specimens may be found showing a passage from greywacke to the rock just described.

The Normanby Goldfield was discovered, about 1872, by Sam Verge (better known as Long Jim), a stockman at Havilah, when camping out in search of wild cattle. He got "colours" in Green Creek, about three miles above its junction with the Dart. Following up these indications, he first lighted on Hibernia Reef, from which he got some gold in white quartz at the surface, and took up a prospecting claim in company with Tom M'Cartney, William Duffey, and another. The Marquis, Welcome, Star of Hope, Albion, Grace Darling, and other reefs were taken up almost immediately after, and for about eighteen months the place bore the aspect of a flourishing reefing district.

As this part of the Clarke Tableland is an absolute blank on all existing maps, I had to preface my proper work by measuring a base-line, taking bearings, making traverses, and in fact performing all the

* The Dart is called Emu Creek in some old maps.

the operations necessary for constructing maps of the district to be described. The broken and wooded nature of the country rendered this unusually tedious. I was ably assisted throughout by Mr. Joseph J. Macdonald.

Two Maps accompany this Report: No. 1 on the scale of a quarter of an inch to the mile, and No. 2 on a larger scale, showing the reefs, and workings on Normanby.

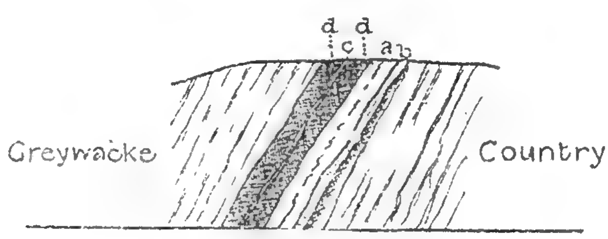
For the sake of accuracy in description, I have laid down on the larger map, the areas embraced by the individual claims on each line of reef, so far as this was possible at the time of my visit. Occasionally a charred peg remained to assist in this determination, but I had mainly to be guided by the number of shafts along the line of reef belonging to each claim, and by the terms of the goldfield laws existing at the time of working with regard to the areas claimable for each miner. But I had chiefly to depend on the recollections of Mr. John Smith, to whom I am also indebted for all the information contained in this Report which could not, in the nature of things, come within my own observation,—for example, the state of the workings in dilapidated shafts, and the yield from crushings. I may state that I place implicit confidence in the accuracy of my informant.

The principal reefs, as will be seen from the larger map, lie along a line running south 44½ degrees east across the heads of the gullies, draining the south-western side of the Normanby Range. A less important parallel line of reefs intersects Hungry Gully and Green Creek near their junction, striking towards Oakey Creek on the north-west. The reefs on both lines invariably underlie to the north-east.

HIBERNIA REEF

Occurs on the ridge between the gully of the same name and New Zealand Gully. Its course is north 17 degrees west, and its underlie east 17 degrees north at an angle of 75 degrees. The prospectors worked the claim for about a year. As has already been mentioned, free gold was found in the quartz at the surface. Half-a-ton of stone was sent down to Sydney a few months after the opening of the reef and gave a return at the rate of four ounces to the ton. An underlie shaft was sunk on the top of the ridge, and was met by a drive a few feet above the level of Hibernia Gully. The drive has now fallen in. John Smith, who visited it after the prospectors abandoned the mine, found the reef to be about 6 inches wide, and obtained poor colours from it. The prospectors had only one crushing, which yielded gold at the rate of 1 ounce 5 dwts. to the ton.

At the top of the underlie shaft the following section is seen (fig. 1):—



a. White Quartz Vein, with very large Crystals, 15 inches.
b. Vein of Quartz with decomposed Pyrites, on footwall of reef, 6 inches. (This vein carried the Gold).
c. Vein of Quartz, 2 inches.
d. Gangue of broken Greywacke.

Fig.—1. Section at Outcrop of Hibernia Reef, Normanby.

The 6-inch vein which carried the gold is a crystalline quartz with interlacing dog-tooth crystals, the interstices being filled up with "brownstone" (decomposed pyrites) and occasional specks of copper pyrites, less decomposed.

A vertical shaft was sunk a few feet to the dip, but was abandoned at a depth of 10 or 12 feet, without having cut the reef.

About 130 yards south-east of the underlie shaft of the Hibernia, three shallow shafts have been sunk on the left bank of one of the heads of New Zealand Gully. The uppermost (south-eastmost) shaft has struck no reef; the country is fine-grained tourmaline-porphyry. The second has followed a trifling leader for a few feet. The third cuts, at a vertical depth of 15 feet, a 2-inch leader of white quartz, containing a little pyrites. The leader has a north-west course, and dips to the north-east at 65 degrees. The country is greywacke. The same leader is seen in a trench in the gully, where it has widened to 15 inches—a very white, vitreous, poor-looking quartz.

Seventy yards to the south of the last-mentioned leader, a small opening has been made on a leader of white quartz, 1 to 5 inches wide. Its course is E. 6 degrees S., with an underlie at 85 degrees to S. 6 degrees W. An underlie in this direction is rare in the neighbourhood of Normanby.

MARQUIS REEF.

The Marquis Reef crosses the crown of the ridge south of the head of New Zealand Gully. It has a N.W. and S.E. course, and underlies to the north-east at about 40 degrees.

The reef was taken up by the prospectors within a few months of the opening of the Hibernia. They began work at a shaft near the western corner of their claim, which they sunk on the underlie for a distance of about 90 feet. They had two crushings of brown honeycombed quartz, which gave 2 ounces and a few pennyweights to the ton at Mr. King's machine. They left the white quartz untouched. In another shaft to the north-west the prospectors struck the reef at a depth of 16 feet, and followed it on the underlie to the level of the workings in the first shaft. They also sunk about 12 feet on the underlie down the hill to the south-east.

After

After being worked for about 18 months, the claim was abandoned by the prospectors. Having lain idle for some time, it was taken up by William Duffey and others. This party sunk a vertical shaft 71 feet deep, on the dip side of the prospectors' first shaft, and struck the reef at the depth of 60 feet. They took out 9 tons of brownstone, which were crushed at Mr. King's machine and gave 2½ ounces to the ton. In spite of this encouraging crushing, the claim was again abandoned in September, 1874, owing to the removal of Mr. King's machine from the field and the opening of Happy Valley Diggings. This was the last crushing done by Mr. King's machine before its removal to Charters Towers. When the claim was for the second time abandoned, the water level had been reached in the bottom of the vertical shaft, and the brownstone had begun to give place to undecomposed pyrites.

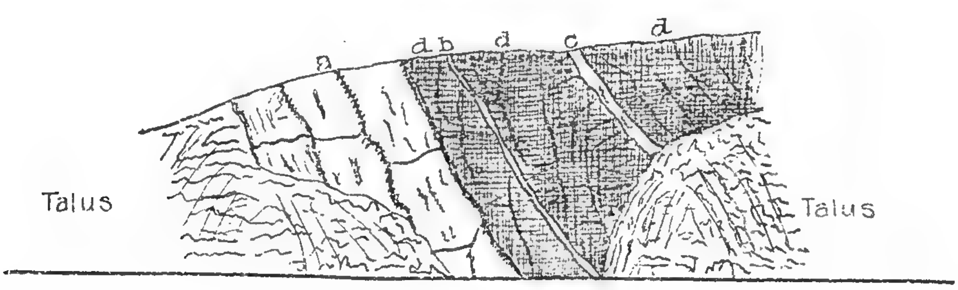
In the hope of getting brownstone similar to that obtained by Duffey's party, an extended claim was taken up by the Venture Mining Company, about May, 1877. They sunk a shaft on the slope of the ridge, 58 feet south-east of Duffey's shaft, and struck the reef at a vertical depth of 45 feet. They then drove 15 feet up the underlie, and broke into the old workings of the prospectors. They next drove from the bottom of their shaft to the bottom of Duffey's. The reef was found to vary from 6 inches to 2 feet in width, with not very distinct walls except at the bottom of the company's shaft, where the foot-wall was hard and smooth; brownstone was obtained in patches, although the quartz was mostly white. The company having brought their 4-stamp machine from the Grant Valley, and erected it at the junction of New Zealand Gully and Marquis Creek, crushed 40 tons of brownstone, which gave 14 dwts. of gold to the ton. At the bottom of the company's vertical shaft the water became too heavy for hand-baling, and the "mundic" was coming in. In the heap left at the surface there is a good deal of copper pyrites and some stains of carbonate of copper.

The company also sunk a shaft on the underlie side of the prospectors' south-eastmost shaft. This shaft cut the reef at the depth of 20 feet, and followed the underlie for 6 feet. The reef was here 12 inches wide—a poor, dull, white stone, from which even "colours" were not obtainable.

Three shafts have been sunk about 100 feet to the north-west of Duffey's vertical shaft, to catch the Marquis Reef, but without success. The north-eastmost shaft has, however, cut a leader of quartz about 3 inches wide—poor, dull, white stone.

NEW ZEALAND REEF.

The New Zealand Reef occurs to the south-east of the Marquis, on a ridge between two of the heads of Marquis Creek. Its course is about 6 degrees to the south of east. It underlies to the north, but at a very low angle, its outcrop following the contour of the ridge. It has a large "blow" at the surface, and was worked extensively in an open-cast. Much of the outcrop is, therefore, still visible. The eastmost point of the open-cast shows the following section (Fig. 2).



a. Reef of White Quartz, highly crystalline on joints and in central cavities, 5 to 6 feet.
b. Leader of White Quartz, 1 to 3 inches.
c. Leader of White Quarts, 8 inches.
d. Decomposed Tourmaline-Porphyry Country.
FIG. 2.—Outcrop of New Zealand Reef, Normanby.

Up the hill (to the west) is a long opencast working, from which the reef has been almost all taken out. Judging, however, by the remaining parts of the walls, it seems to have been three or four feet in width. Numerous leaders enter the reef from the south or foot wall—a circumstance which renders the existence of an underlying reef more than probable. A crushing of 90 tons from this working gave 2 ounces of gold to the ton. The country is decomposed greywacke.

In the westmost shaft in the prospecting claim (on the top of the ridge) the reef was cut at a vertical depth of 10 feet, and followed on the underlie for about 60 feet. At this depth the reef got narrower, and became a white "buck" with but little brownstone. A crushing from this shaft only yielded one ounce to the ton. A drive was made from the bottom of the vertical shaft for 10 feet to the west, and for a much longer distance to the east, and from this level a great part of the first crushing was taken. The reef at the western end of the drive is about one foot wide.

In a shaft, 70 feet deep, sunk on the underlie side of the east end of the opencast working, the reef was not reached; at least only a 6-inch reef or leader was found, which was supposed to be that marked C in the preceding sketch. But, as the reef was found to thin away so much in the bottom of the deep underlie shaft, it is quite possible that the leader in the 70-feet shaft really was the reef. The quartz at the mouth of the shaft is dull white, with large crystals in cavities, their surfaces coloured bright yellow. Very small "nests" of brownstone occur in the quartz, as well as a little carbonate of copper. Among the large quartz crystals, cubes of brownstone occur, still retaining perfectly the crystalline form of the original pyrites. The decomposed pyrites crystals are clustered on the faces of the quartz crystals, but never indent them, and appear therefore to have been formed after the consolidation of the quartz.

The workings of the prospectors commenced a short time after the Marquis Reef was taken up.

When the Venture Company abandoned the Marquis, they sunk a vertical shaft, 12 feet deep, in the gully, on the outcrop of the New Zealand Reef (east of the opencast workings), but found the reef pinching out.

The

The prospectors found a leader in the same line on the opposite side of the gully from their workings; but, as the rise of the surface on that side should carry the outcrop of the reef a good way to the south, I doubt if they were correct in supposing this leader to represent the New Zealand Reef.

The Venture Company trenched about 30 feet up the slope on this side of the gully, and discovered a reef of very white stone (no colours) about one foot in thickness. I am inclined to think that this was the real New Zealand Reef. It occurs, at any rate, where the reef might be expected to be met with, and the stone is very similar in character.

The country of the New Zealand Reef is greywacke and tourmaline-porphyry, specked with pyrites. One small specimen was picked up of half-metamorphosed greywacke, traversed by a vein of chalybite (carbonate of iron). The broken-up country (mullack or gangue), between the walls of the reef, is frequently impregnated with carbonate of copper.

A shaft was sunk to the west of the prospecting claim to a depth of 30 feet, in a line with the open-cast workings. But, as the curve caused by the fall of the ground was not taken into account, the attempt to reach the reef was fruitless.

In a shaft north of the one last mentioned, a small quartz leader was found at the depth of 20 feet. The leader underlies to E.S.E., and is probably the representative of the New Zealand Reef, although no gold was obtained from it. The country is tourmaline-porphyry, with a little greywacke.

A shaft, 20 feet deep, between the last-mentioned shaft and the Marquis Reef (in greywacke country, with a little tourmaline-prophyry) has struck a 3-inch vein of very poor-looking, vitreous, bluish-white quartz.

DILLON'S REEF

Lies to the south-east of the New Zealand Reef, on the next branch of the Marquis Creek. Its course is S. 36 E., and its underlie to E. 36 N. The reef is two feet wide and upwards. It is a very white quartz, but is highly crystalline in the central parts; the cavities being filled with brownstone. On the right bank of the gully the reef is very flat, except in the deepest shaft (30 feet deep), where it pitches more steeply. On the left bank the underlie is much greater, about 75 degrees. Three crushings were taken from this reef, the first realising 1 ounce 5 dwts., and the second and third 17 dwts. of gold to the ton.

STAR OF HOPE REEF.

This reef was taken up about the same time as the Marquis, and worked by the prospectors till the removal of Mr. King's machine (about eighteen months). It bears S. 35 degrees E., and underlies to E. 35 degrees N.

The workings in the prospecting claim consist of two shafts on the crown of the ridge (the north-westmost in the claim), an open cast 20 feet in length, along the cap of the reef on the slope of the hill, a shaft 40 feet vertical on the underlie side with a drive back to cut the reef, and a drive into the hill at the level of the gully (one of the heads of Garibaldi Creek). Besides the above, two small shafts were sunk to the underlie, but failed to reach the reef.

A little free gold was obtained from white quartz on the cap of the reef. The quartz is generally white, with occasional large crystals, now and then showing patches of decomposed pyrites. Joints and cavities are sometimes coated with green carbonate of copper. The country is fine-grained tourmaline porphyry, but some fine-grained hornblendic greywacke, veined with serpentine, has been brought up from the 40 feet shaft on the underlie side of the reef. The "country" in the neighbourhood of the reef is specked with pyrites. The prospectors had two crushings, which yielded about 1½ ozs. of gold to the ton.

No. 1 Claim North.—On the north-west side of the hill from the prospecting claim. Very little has been done on this claim, and it is believed never to have had a crushing. The workings consist of three shallow shafts and an opencast. A small heap of fair crystalline quartz lies at the surface.

No. 1 Claim South (south-east of prospecting claim).—The reef was worked opencast over the whole length of this claim. The underlie was about 45 degrees at the surface, but at the depth of 20 feet the reef pitched at a much higher angle. The brownstone gave out where the steep underlie commenced, and the reef became very white and barren. Water and mundic came in shortly after the steep underlie. The reef appears to have been here about 2 feet wide, judging from some of the blocks at the surface. Some of the quartz in the heap lying at the surface contains a little pyrites, with which the country (fine-grained hornblendic greywacke and tourmaline-porphyry) is also specked. The pyrites in the reef is very similar in character to that of the Welcome Reef, to be afterwards described.

A shaft at a distance of 15 feet from the outcrop reached the reef at a depth of 20 feet. Another shaft, further to the dip, did not reach the reef, being abandoned (at 15 feet deep) owing to the results of the second crushing (from a deeper part of the reef). A third shallow shaft, still further to the dip, did not, of course, reach the reef, which must there be at a considerable depth.

The first crushing (70 tons) of brownstone from the surface of the reef gave 3 ozs. 7 dwts. of gold to the ton. The second and last from the deeper workings, gave only a little over one ounce to the ton. The claim was abandoned after this crushing. It is believed that the owners took out the greater part of the payable brownstone within the limits of their claim.

No. 2 Claim South.—This claim lies to the south-east of No. 1 claim south. The continuation of the reef was never found, although five shafts were sunk for the purpose—one to a depth of 50 feet. The obvious explanation is, that in four of the shafts the reef lay at a greater depth than that to which the sinking was carried, while the fifth was sunk below the outcrop. The country is similar to that of No. 1 claim south and is copiously specked with pyrites.

For the next 500 yards along the line to the south-east the reef was never found, although the two ridges (site of the Sharkeytown Camp) were diligently searched by trenching in all directions.

WELCOME

WELCOME REEF.

This reef runs E. 44 degrees S. and underlies to N. 44 degrees E. at about 70 degrees.

The Prospecting Claim was taken up by Hugh Clerkin and others about six months after the Marquis, and was abandoned prior to December, 1874.

The north-westmost shaft is 15 or 18 feet in vertical depth, and follows the underlie for 70 feet further. The reef was also taken out between the bottom of the vertical shaft and the surface. At 45 feet down the underlie from the bottom of the vertical shaft, water (not very heavy) and mundic were met with. A drive to the south-east connected the workings of this shaft, at the 50 feet level, with two other shafts. The country is a dark, fine-grained tourmaline-porphyry, poor in quartz, with pale iron pyrites scattered throughout.

The prospectors sunk a second shaft 50 feet north-west of the first. It cut the reef at the depth of 40 feet, and followed it up to daylight and down the underlie. The shaft was also connected by the abovementioned drive with the shafts to right and left. The mundic level was reached in the underlie workings. The country in the shaft is a fine-grained, cream-grey syenitic granite, with cream-coloured felspar, quartz, hornblende, and minute scales of tin-white mica.

The prospectors' north-westmost shaft is 41 feet north-west of No. 2, in fine-grained, somewhat crystalline, hornblendic greywacke. It cut the reef at a vertical depth of 50 feet, and followed it down the underlie, and was connected by the drive with the other two shafts. There is said to have been a 2-feet mundic reef in the underlie.

The prospectors had two crushings (of brownstone), which realised about two ounces of gold to the ton, at Mr. King's machine. They took out five or six tons of white stone with mundic. Mr. Saunders, Mr. King's manager at the machine, stamped and roasted half-a-ton of the white mundic stone, and got two ounces of gold (= four ounces to the ton). Some of the stone was sent to Ravenswood, where it gave a result variously stated at five to seven ounces to the ton.

The Venture Mining Company took up (in December, 1877) an extended claim (3,600 feet along reef by 400 feet). They sunk a shaft, 45 feet to the dip of the north-westmost shaft of the prospectors, to a vertical depth of 30 feet, at which depth they stopped short of the reef. The country is similar to that in the south-east shaft of the prospecting claim. They raised one and a-half tons of mundic stone from the bottom of the prospectors' north-west shaft, where they found a mundic reef varying from nine to twenty inches. Having been beaten off by a suffocating and poisonous air, in which a candle would not burn, evidently carbonic acid gas accumulated owing to want of ventilation, they made up two tons by taking half-a-ton from the old heap left by the prospectors. The two tons of mundic stone were crushed by the company's machine at New Zealand Gully, and yielded twenty-two pennyweights of gold to the ton. The tailings, on being roasted and amalgamated, gave gold at the rate of five ounces to the ton. The gold from the tailings was sent to the Sydney Mint, and pronounced only worth thirty-seven shillings per ounce. On receipt of this return the sinking of the straight shaft was stopped and the claim abandoned. The company, exhausted by unprofitable work at the Venture Reef, "dead" work at the Marquis, and prospecting at the New Zealand, gave up the struggle, and thus ended the last reefing done at Normanby.

The mundic stone heap now lying at the surface (about five tons) is, of course, all of the prospectors' raising, and has probably been picked again and again for the best specimens. The mundic is mostly in minute crystals, and occurs in white uncrystallised quartz. It is a mixture of very pale iron pyrites and yellower copper pyrites. Occasionally a little green carbonate of copper is mixed up with the copper pyrites.

A specimen of the mundic taken home by me was assayed by Mr. Thos. Buckland, Charters Towers, and gave a gold return of 8 ozs. 9 dwts. 20 grs. to the ton, and a silver return of 1 oz. 12 dwts. 6 grs. to the ton. The specimen was pure pyrites, picked free from quartz.

No. 1 Claim North.—This claim (to the north-west of the prospecting claim) was taken up while the prospectors were still working. Two shafts were sunk to the depth of 20 feet, but without coming on the reef. Taking the fall of the ground into account, it is probable that both shafts were sunk below the outcrop of the reef. The country is dark-grey tourmaline-schist and fine-grained hornblendic greywacke (frequent junctions seen). The rock is specked throughout with pyrites, and is fresher than is usual on the field.

No. 1 Claim South (south-east of prospecting claim).—Two shafts were sunk, neither of which seem to have reached the reef. A little quartz at the surface has probably come from small leaders. One specimen shows pyrites far gone in decomposition towards brownstone. The country is similar to that in the south-east shaft of the prospecting claim.

No. 2 Claim South.—The north-west shaft in this claim caught a reef or leader, and followed it down the underlie; this was probably a leader parallel to, and above, the Welcome Reef. What little is left of it is of white barren-looking quartz, with only a few specks of brownstone, and seems mostly to have come from a vein not more than two inches wide, as evidenced by the slickensided faces on each fragment. The country is similar to that of the south-east shaft of the prospecting claim, but there is also mixed up with it some amygdaloidal porphyry, probably from a dyke.

The mid shaft is of no depth, and has not caught the reef. The country is the same as in the north-west shaft.

The south-east shaft appears to have been sunk on a cross leader bearing north-east and south-west. A little quartz has been got from a two-inch leader with crystalline cavities in the middle. Sometimes a little brownstone occurs in the casing. The country is mixed tourmaline-porphyry and serpentine. No stone was crushed from No. 2 claim.

All attempts to find the Welcome Reef to the south-east have proved fruitless.

The above reefs have been described in their order from the Hibernia south-eastward. Returning to the Hibernia, we now follow the line in the opposite direction.

On the ridge north-west of the Hibernia is a vertical shaft, about 25 feet deep. It then follows for some distance the underlie of a quartz vein about four inches in width, well slickensided on both sides. The stone has a particularly "hungry" appearance—dull-white and uncrystallised, with scarcely a trace of brownstone. The underlie is to the north-east. The country is greywacke.

One

On the left bank of the next gully (a branch of Hibernia Gully) two shafts have been sunk, one vertical and the other from the surface down the underlie (45 degrees) of a 9-inch reef of white quartz, with interlacing crystals in the middle. There is but little brownstone. The amount of work done has evidently been trifling. The country is greywacke.

On the south-east slope of the next ridge are too little shafts. In the lower, at the depth of about 12 feet, a very white quartz vein, poor in brownstone, has been cut. The shaft appears to have been abandoned at once, owing to the unpromising character of the stone. Some specimens of the stone are veined with chalybite. In the upper shaft, at the depth of about 20 feet, a 4-inch leader is cut, and followed for a few feet. The quartz is white, and looks peculiarly unpromising. The country is fine-grained tourmaline-porphyry.

On the north-west side of the same ridge is a group of trial workings, consisting of two openings on a leader of some 8 inches, hading to the north-east at 45 degrees, and a vertical shaft about 15 feet deep. The latter shaft has probably cut the same leader. The stone brought up (very little) is white and barren-looking.

Further down the slope of the same ridge are two shafts. One appears to have caught (at 12 feet deep) a joint in the rock, possibly representing the Glengarry Reef, for which it was doubtless sunk. The prospectors seem to have been disappointed in this, as no quartz has been raised. The country is shivery, much-jointed greywacke. The other shaft (to the north-east) is only 8 feet deep, and has caught no reef. The country is dark-grey, coarse-grained tourmaline-porphyry, the tourmaline crystals being occasionally grouped together in black shining masses.

GLENGARRY REEF.

This reef occurs on the side of the hill, below the two last-mentioned reefs. It bears west 15 degrees north, and underlies to north 15 degrees east at about 50 degrees, being evidently a continuation of the Grace Darling Reef. It is 10 inches wide, of highly crystalline white quartz, with the spaces between the crystals filled up with decomposed pyrites. The hanging wall is of greywacke, and the foot wall of a hard, white elvan—probably a dyke. The reef was worked, at first, open-cast, and then from three shafts sunk to the dip; the deepest about 25 feet. At this depth the reef is said to have split up into leaders. Only one crushing was taken out (from the opencast workings). It gave half-an-ounce to the ton. The gold from the Glengarry had the highest mint-value of reef-gold on the field—viz., £3 9s. per ounce.

A shaft was sunk about 15 feet deep, between the Glengarry workings and the gully to the north west, but the reef was not found. The country is dark-grey tourmaline-porphyry, with some greywacke.

GRACE DARLING REEF.

This is by far the longest continuously-worked reef on the field. Including the Glengarry, it extends for 420 yards, in a line running east 38 degrees south, to east 15 degrees south.

Prospecting Claim.—This claim was taken up very shortly after the Hibernia. The "blow" is visible on the Grant road, and in two shallow shafts to the west. It is about 18 inches wide, and hades to the north-east at about 40 degrees. The hanging wall shows *debris* of fine-grained tourmaline-porphyry. The quartz is white, but well honeycombed (from the decomposition of pyrites), brown on joints and faces, and with decomposed pyrites in spaces between the crystals. The first crushing, of about 100 tons, from the surface of the reef, gave 1 oz. 15 dwts. of gold to the ton.

The prospectors sunk two deep shafts: the shallower was about 40 feet vertical; the deeper, on which a horse-whim was erected, was 45 feet vertical; the reef not having been reached at this depth. In the bottom of this shaft the water-level was reached. About the same time there was a rumour that Mr. King's machine was about to leave the field. The prospectors, to be in time, drove back and caught the reef at the 45-feet level, and took out 30 tons of brownstone, which crushed 1½ ozs. to the ton. The white stone was richer in gold in this claim than was usual on the field. The country is coarse-grained tourmaline-porphyry.

No. 1 Claim South.—This claim has two deep shafts (about 35 feet) and four shallow ones on the underlie from the outcrop. The reef is a little over 8 inches wide. It is a highly crystalline yellow ochreous stone, the crystals being stained yellow on the faces. Some cavities are pretty rich in brownstone. The owners of the claim had only one crushing, which gave about an ounce to the ton.

No. 2 Claim South had three shafts, two sunk vertically to the reef (about 25 feet) and one on the underlie from the outcrop. The stone is in blocks of 9 or 10 inches in thickness, and this appears to have been the size of the reef. It is a very white quartz, with crystalline cavities and joints stained red and yellow with iron oxide. The country is fine-grained tourmaline-porphyry. The only crushing from this claim realised 3 or 4 dwts. to the ton.

No. 1 Claim North.—The owners of this claim sunk two shafts on the left bank of Green Creek. Both shafts caught the reef, the upper at 25 feet, and the lower at 10 feet from the surface. On following the reef to the underlie, the water was found to interfere seriously with the work. One crushing (1 oz. 5 dwts. to the ton) was taken out of the upper shaft. The quartz is white, with some crystalline cavities filled with ochreous decomposed brownstone, and coated on joints with yellow ochre. The country is fine-grained tourmaline-porphyry, with some greywacke.

No. 2 Claim North.—The reef is seen here in an underlie shaft on the outcrop. It is a very white quartz, like that in No. 1 North, but the specimens visible appear to be rather richer in decomposed pyrites. A crushing from this shaft gave 1 oz. 2 dwts. of gold to the ton. Two shafts, 20 feet deep, show coarsely crystalline tourmaline-porphyry, with specks of pyrites throughout. These shafts did not reach the reef.

Near the head of the western branch of Green Creek are three small openings, apparently on an insignificant leader. Some very small fragments of quartz are all that is to be seen.

Five hundred yards farther to the north-west are three shallow shafts, which have followed something on an underlie to the south-east. A little quartz has been taken out. It is crystalline, and brown on joints, although very white inside.

On

On a hill top, 300 yards south-west of the last-mentioned shafts, and 600 yards north-west of No. 2 North Grace Darling, is a shaft in which a three-inch quartz vein has been followed down from the outcrop. It strikes west 1 degree north, and dips to north 1 degree east at 65 degrees. This is believed to be the place from which "Scotch Eliott" crushed 5 tons, which gave 3 ounces to the ton. Two small shafts sunk higher up the hill have failed to catch this (or any) reef.

Leaving the principal line of reefs, we find a few on the summits of the Normanby Range. One of these crosses the Grant road just on the west side of the pass which carries the road over into the Grant Valley. It runs north 21 degrees west and dips to east 21 degrees north, a spring rising on its upper side, forming the head of Green Creek. It has been opened out a little in a hole on the south-east side of the road, and appears unusually rich in brownstone for this locality. From its appearance it would be considered a very promising reef, but it yielded no "colours" to the prospectors. With a view to testing whether any gold had been washed from the surface, I had the bottom of the gully tried at an angle where much of the wash from the reef must certainly have been caught, but with a purely negative result.

On a long summit of the range, north of the Marquis and east of the Glengarry, a large "blow" of quartz occurs. Its course is east 36 degrees south, and its underlie to north 36 degrees east. It is 6 feet wide at the south-east end. The quartz is white, with joints stained with peroxide of iron. To the north-west the reef not only narrows, but becomes more mixed with decomposed pyrites. Three shallow holes have been sunk on the outcrop. The country is greywacke, dipping at a high angle to the north-east.

North of the Welcome and east of the Marquis, another reef is seen on a summit in the range. It runs east 31 degrees north, and underlies to south 31 degrees east at 85 degrees. It is white and uncrystallised, and averages one foot in thickness. The country is fine-grained pyritous tourmaline-porphyry.

On the ridge between the Welcome mines and the head of Spring Creek is a quartz reef three or four feet wide, bearing north 6 degrees east and underlying to east 6 degrees south. As a rule, the stone is white and vitreous, but a fair-sized heap (five or six tons) of picked stone lies at the bank. There are two openings on the outcrop and one vertical shaft. The latter has tumbled in, but does not seem to have reached the reef, although only about five yards distant from the outcrop. The underlie appears to be steep. The quartz in the heap is coloured yellow and brown, with iron oxide on surfaces and joints, and contains (rather rare) blotches of copper, and iron pyrites and stains of green carbonate of copper, besides frequent "nests" of chlorite. It is full of cavities, whose interior is lined with quartz crystals, much browned, as if masses of iron ore had weathered out. The walls are of decomposed tourmaline-porphyry. Fine "colours" and some thready gold were obtained from the reef by J. Smith. The reef was opened (while the adjacent Welcome was working), but no crushings were taken out of it.

On the opposite side of the Normanby Range, in the Grant Valley (west fork), occur the Enterprise, Albion, and Venture Reefs.

ALBION REEF.

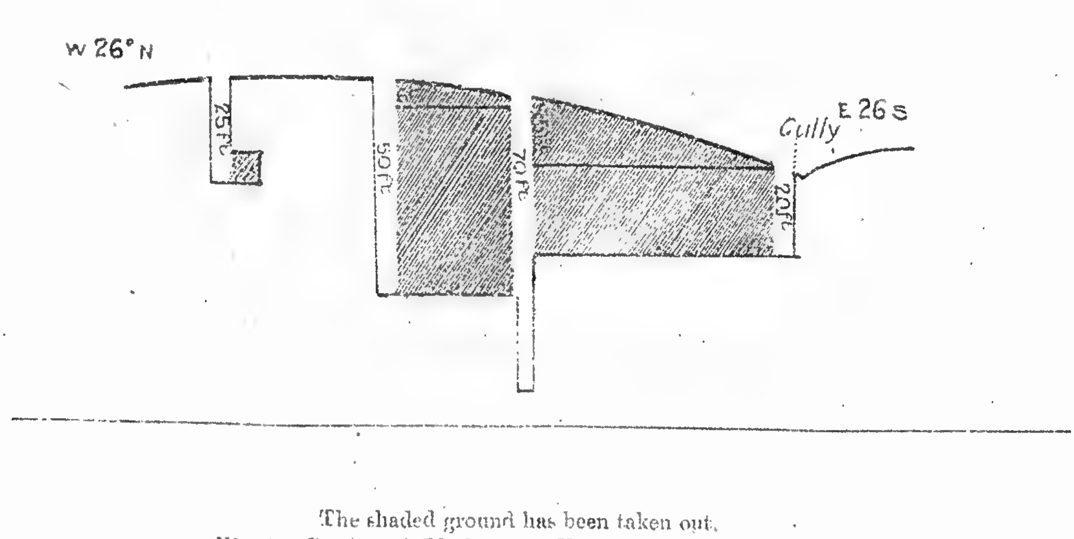
The Albion Reef occurs on the gully of the same name, falling into the west fork of the Grant. It runs west 39 degrees north, and underlies to north 39 degrees east at about 55 degrees. It varies from 2 to 6 feet wide, bulging out to 10 feet in places. It is generally a very compact white vitreous quartz, with brown stains only on the joints. In places it is "rubbly," or intersected by frequent joints, all iron-stained. It is rarely crystalline. The country is greywacke and shale. The mine was taken up by Long Jim and others about two months after they took up the Hibernia. Half-a-ton of stone, sent to Sydney shortly after the opening of the reef, gave gold at the rate of 2 ounces to the ton. They had afterwards a crushing (at Mr. King's machine) from the top of the reef, which gave 1 ounce 5 dwts. to the ton.

The Albion Co. next took up the claim in 1875. They made a drive of 50 or 60 yards in length into the hill, and worked the reef up to daylight (about 80 feet on the underlie) and down the underlie for about 15 feet. The company had a machine on the Grant, about half-a-mile from the mine, and had several crushings, the best giving 11 dwts., and the worst $2\frac{1}{2}$ dwts., to the ton. Their machine was afterwards removed to Marengo.

A little below the mine the bedding of the rock is seen—a rare occurrence in this neighbourhood. It is quartzose greywacke and chlorite slate, nearly on end, but with a slight dip to the north-east.

VENTURE REEF.

The Venture Reef lies about half-a-mile S.S.E. of the Albion. It runs E. 26 degrees S. with a very slight hade to N. 26 degrees E. The following sketch shows the extent of the workings. (*Fig.* 3.)



The shaded ground has been taken out.
Fig. 3.—Section of Workings on Venture Reef, Normanby.

The

The mine was taken up by Fred. Burstall about the same time as the Albion. He took 25 tons of brownstone from the top of the 70 feet shaft, which crushed 1 ounce 18 dwts. to the ton (at Mr. King's machine). He sunk the 70 feet shaft to the depth of about 40 feet.

The rest of the work was done by the Venture Company, who took up the claim prior to their operations at the Marquis. They found water (not heavy) at the depth of 65 feet in the 70 feet shaft. Their first crushing was 70 tons at their own machine,* beside the mine. It only yielded 11 dwts. to the ton. Only 11 tons more were taken out, from the bottom of the 25 feet shaft. This parcel gave a somewhat better result, viz., 18 dwts. to the ton.

In the 25 feet shaft the reef was only 6 inches wide; in the 50 feet shaft it averaged 18 inches; and in the 70 feet shaft, 2 feet. Below the 50 feet level the stone was very white, with yellow coatings. A good deal is now lying at grass. It shows specks of fine cubical iron pyrites.

The country at the mouth of the 50 feet shaft is fine-grained greywacke and shale, and at the mouth of the 25 feet shaft, fine-grained tourmaline-porphyry.

ENTERPRISE REEF.

This reef occurs on a spur on the right bank of Enterprise Gully. It runs E. 29 degrees N., and underlies at about 80 degrees to N. 29 degrees W. The mine was worked about 1876-7. The reef is 6 to 12 inches wide; it was worked at two levels on the hillside. In the upper level the reef is seen to thin downwards in an opencast. It is a white vitreous quartz, with cavities faced with very large crystals, the interstices filled up with decomposed pyrites, and with some faces coated with copper pyrites. About 8 tons of quartz lie at bank here, but none was crushed from this level. The walls are of decomposed granite.

At the lower level the prospectors drove into the hill, and also went down on the reef for 10 or 12 feet. Where the reef has been left it has pinched out to 2 or 3 inches, but it must have been 10 inches wide in places, as evinced by the size of the blocks taken out. About 4 tons from this level and 3 from a lower level (at the edge of the gully) were crushed at the Venture Company's machine before its removal from the Grant Valley, and gave 8 dwts. gold to the ton. Two tons of this stuff are left at bank. It is much whiter than the stone from the upper levels (with a little blue carbonate of copper), but it is said to have given better prospects.

In the Enterprise Creek, below the reef, one half-ounce and one 14 dwt. nugget were found, besides coarse "colours." Above the reef no gold could be obtained.

JUST-IN-TIME REEF.

This reef lies between Hungry Gully and Oakey Creek, south of the Bowen road. It runs west 25 degrees north, and underlies to north 25 degrees east at about 45 degrees.

The Prospecting Claim was taken up by John Smith and others about six months after the Hibernia. They took out 25 tons of brownstone, which crushed 1 ounce 8 dwts. to the ton. The next crushing, of 40 tons, gave 1 ounce 12 dwts. The last gave 1 ounce 7 dwts. The reef averages 5 inches in width, but thins away to 2 and bulges out to 9 in places. The prospectors went down about 70 feet on the underlie. They had not reached the water-level even at that depth. The claim *paid* while Mr. King's machine remained on the field. The gold was getting a little rougher in the deeper workings, and the stone rather more stained with carbonate of copper. The Mint value of the gold was £3 7s. What little is left of the stone is of the usual character, essentially white and vitreous, but with frequent crystalline cavities filled with decomposed pyrites. The country is a somewhat coarse-grained pyritous tourmaline-porphyry. It was soft and easily worked in the prospecting claim, requiring little blasting.

No. 1 Claim.—The reef here is narrow, as is the case in the prospecting claim. The claim was first held by the prospectors, and afterwards by Mr. King, who put two men on it. The reef was sunk 45 feet on the underlie, and cut at the depth of 40 feet in a vertical shaft. Two crushings of the brownstone yielded, the first 1 ounce 8 dwts., and the second 1 ounce 5 dwts. of gold to the ton. At the bottom of the vertical shaft the mundic began to come in. I took home a specimen of this mundic (free from quartz), and it assayed 6 ounces 4 dwts. 3 grs. of gold, and 5 ounces 11 dwts. 1 gr. of silver, to the ton.

No. 2 Claim.—A shaft, 20 feet deep, was sunk, but did not cut the reef. A trench failed to discover the outcrop.

REEF S.W. OF JUST-IN-TIME.

On the gully to the south of the Just-in-Time workings are five shafts, and a line of opencast workings on a reef running west 11 degrees north, and leading to north 11 degrees east at about 70 degrees. A shift at the junction of this reef with the Just-in-Time may explain why the latter was not found in No. 2 Claim. The reef is 6 inches to 1 foot wide, and shows a mixture of brownstone and very fine white quartz. The quartz and gangue of the reef are often a good deal stained with carbonate of copper. The country is tourmaline-porphyry.

This reef was worked simultaneously with the Just-in-Time. It had two crushings; the first (20 tons) giving 1 ounce 5 dwts. of gold to the ton, and the second (30 tons) 1 ounce 7 dwts.

REEF NORTH OF JUST-IN-TIME.

A reef running W. 16 degrees N., and underlying to N. 16 degrees E. at 65 degrees, occurs between the Just-in-Time workings and the Bowen road. At the eastern end the reef is 2 to 6 inches wide. It was sometimes 12 inches. It is a white crystalline quartz with yellow joints. The country is tourmaline-porphyry.

This mine was worked simultaneously with the Just-in-Time. The workings reached a depth of 30 feet in the underlie. Only one crushing (30 tons) was taken out. It gave 15 dwts. to the ton. The gold was rough for this field, the particles being visible to the naked eye. One speck is said to have weighed 3 dwts.

LARDYDA

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* This machine was afterwards removed to its present site, on New Zealand Gully.

LARDYDA REEF.

This reef lies north-west of the Just-in-Time, on the east side of the Bowen road. Its direction is W. 26 degrees N., and its hade to N. 26 degrees E. at about 50 degrees The mine was worked at the same time as the Just-in-Time. The quartz sometimes bulged out to 6 or 8 inches in width, and sometimes was only represented by a "mullack vein" (gangue without reef). The workings only reached a depth of 30 feet. Eleven tons were crushed at Mr. King's machine, and yielded 17 dwts. to the ton. The country is fine-grained and tourmaline-porphyry.

REEF BETWEEN HUNGRY GULLY AND GREEN CREEK

This reef occurs on the right bank of Green Creek opposite Mr. Campbell's Stockyard. It runs W. 36 degrees N., and hades to N. 36 degrees E. Twenty-five tons of brownstone were crushed at Mr. King's machine, and yielded gold at the rate of 1 ounce 2 dwts. to the ton. The country is tourmaline-porphyry and greywacke.

REEFS IN MR. CAMPBELL'S PADDOCK.

Near the slip-panel, south-east of the stockyard, two shallow shafts have been sunk on a small leader running W. 26 degrees N. and hading to N. 26 degrees E. at 60 degrees. The country is fine-grained pyritous greywacke.

At the head of the gully, between the garden and stockyard, are three or four shallow openings on a quartz leader, which runs N. 39 degrees W. and hades to E. 39 degrees N. The country is tourmaline-porphyry. A small quantity of brownstone was raised from this leader. Three tons crushed at Mr. Kng's machine gave 2 ozs. to the ton. The leader was found to pinch out, as may be seen in the north-west opening..

Near this reef, just outside the paddock, two shafts were sunk on a small leader of poor white stone, striking N. 39 degrees W., and hading at 45 degrees to E. 39 degrees N.

WILD SCOTSMAN REEF.

This reef occurs on the eastern slope of Mount High, with a course S. 34 degrees W., and hades W. 34 degrees N. at 70 degrees. At the south-east end it is represented by a 10-inch granite vein (in fine-grained tourmaline-porphyry country), which soon pinches out (as may be seen in the opencast workings), and gives place to a 3-inch leader of quartz with brownstone. Some brownstone from the north-east end of the reef crushed for about 1 oz. to the ton at Mr. King's machine. The reef was too thin to pay. Between the opencast working and the upper gully is a vertical shaft which catches the reef at a depth of 25 feet and follows it on the underlie for a short distance. As seen in the upper gully, the reef or leader is only about 1 inch wide. The shaft above the upper gully is 15 feet vertical, and follows down the underlie a few feet. From this shaft only a little quartz has been raised, similar to that of the 1-inch leader in the gully.

PERSEVERANCE REEF.

This reef occurs on the east side of the Bowen road, between two of the heads of Oaky Creek, nearly in a line with the Wild Scotsman; it runs W. 21 degrees S., and hades to N. 21 degrees W. at about 65 degrees. It has been worked opencast for the whole length of the prospecting claim, and two deep shafts have also been sunk. The reef was "bulgy," like the Lardyda, sometimes pinching out altogether. A little of the stone lying about is white, with yellow stains on joints, and has come apparently from a narrow reef. Only one crushing of 35 tons was taken out; it yielded, at Mr. King's machine, gold at the rate of 1 oz. 5 dwts. to the ton. The country is fine-grained pyritous tourmaline-porphyry and greywacke.

On the crest of the Normanby Range, between Mount Flattop and Mount High, is a small quartz reef dipping at a low angle to the west. The quartz is white and highly crystalline.

MOUNT FLATTOP REEFS.

This summit is seamed with reefs running from north 11 degrees east to east 29 degrees north, and all underlying to the west or north-west.

At the west end of the hill a 1-foot reef of fine-looking shivery honeycombed red quartz, running north 11 degrees east, and hading to west 11 degrees north at 80 degrees, has been worked in a surface drive. It splits into two leaders at the north end of the drive.

To the east of this are two leaders of brownish quartz from 1 to 2 inches wide, running north 26 degrees east and hading at 80 degrees to west 26 degrees north.

Still further to the east (up hill) is a short drive on three small leaders of promising reddish shivery quartz with gangue of decomposed granite between. They run north 26 degrees east and underlie at 80 degrees to west 26 degrees north.

Higher up the hill a short drive has been made on two leaders, 3 feet apart. The lower is 8 inches wide —a fine-looking honeycombed quartz, with cavities filled with red decomposed pyrites. The quartz of the upper leader (3 inches wide) is white and compact. They run E. 39 degrees N. and underlie to N. 39 degrees W. at 80 degrees.

Fifty feet higher up the hill, is a short drive in a 4 to 8-inch leader of white quartz with small cavities filled with decomposed pyrites; it runs east 24 degrees north, and underlies at 80 degrees to north 24 degrees west.

Within the next 100 yards up the hill, at least half-a-dozen thin leaders, parallel to the last, have been worked opencast or in shallow drives.

Near the east end of the hill-top is a reef, bearing east 29 degrees north and underlying to north 29 degrees west at 65 degrees. It is 8 or 9 inches wide, of white crystalline quartz. The country is granite.

The stone from some of the Flattop Reefs ought to be pretty rich. The opportunity for distinguishing between the payable and non-payable leaders was, however, lost by crushing them all together. It gave 11 dwts. to the ton. A tunnel, in a north-west direction, through the mountain would probably lead to the discovery of several payable mundic reefs.

REEFS

REEFS NORTH OF MOUNT HIGH.

On the west side of the Bowen road, north of the Gap through the Normanby Range, a little leader, running west 5 degrees south, and hading to north 5 degrees west, was followed a few feet in an underlie shaft. A vertical shaft was also sunk on the underlie side, but it does not appear to have reached the leader. The work was done about six months after the opening of the Hibernia. It is believed that no crushings were taken out, unless it might be that the stone was mixed up with that from the Eureka Reef.

About a quarter of a mile to the north is a reef, 3 or 4 inches wide, which was taken up by T. Macartney about the same time as the last. It was worked opencast, except towards the gully, where it was followed down the underlie to the depth of 25 or 30 feet. It crushed, at Mr. King's machine, at the rate of 3 ozs. and a few dwts. to the ton. The country is tourmaline-porphyry.

EUREKA REEF.

This reef, situated to the north-west of Mount High, between two of the heads of the Dart, was opened out simultaneously with the Just-in-Time. It runs west 24 degrees south, and is almost vertical.

The reef is about 3 feet wide, the quartz shivery and jointed ("rubbly"), and split up by courses of gangue. The joints of the quartz are generally coated with yellow, and sometimes stained with blue carbonate of copper. Large quartz crystals are rare. There are frequent cavities filled up with good-looking brownstone. The appearance of the stone, indeed, would warrant a higher estimate of its value than the crushings justified. The first gave 11 dwts., the second, 13 dwts., and the last, 9 dwts. of gold to the ton. The mint value of the gold from the first crushing was only £2 6s. per ounce. The deepest shaft is 40 feet. The country is greywacke, stained in the neighbourhood of the reef with carbonate of copper.

The general character of the reef gold from Normanby is said to have been very fine, as a rule, occurring in specks invisible to the naked eye. Alluvial gold from the field is, on the other hand, generally coarser, up to about the size of a small pea. The banks buy it at £3 12s. per ounce. What specimens of it I have seen are only slightly waterworn, and have numerous minute cavities coated with red peroxide of iron. This appearance is no doubt due to the decomposition of the pyrites with which the gold was originally associated in the reefs.

The difference in the characters of the reef and alluvial gold have led some of the miners on the field to the belief, that the latter has been derived from other reefs than those which have been known and worked; but, although the existence of reefs still unknown is in the highest degree probable, I see no great necessity for this explanation. Gold so fine as that which is said to have been commonly obtained from the reefs would be distributed by the streams so widely as to render its collection unprofitable, while only the larger and heavier grains would be detained by natural obstacles in the beds of the creeks and gullies near the reefs. The alluvial gold is very partially distributed. Diggers sometimes work for months without seeing more than "colours," but occasionally drop on a payable patch. From all I can learn, I believe that the alluvial gold taken from Normanby has cost in labour a great deal more than its money value. The largest nugget I have heard of weighed two ounces.

A miner named Brown informed me that he had found a few dwts. of native gold amalgam in Green Creek, just below the junction of Oakey Creek, in alluvial gravel.

MARENGO.

This goldfield occurs between Selina Creek and Boundary Creek, tributaries of the Don River. It lies S. 32 degrees W. from Bowen, the direct distance being 23 miles, and the distance by the road up the Don Valley being about 25 miles.

In this region, a low tableland—a spur of the Clarke Range projecting to the north—divides the head waters of the Bogie from the parallel valley of the Don. The lithological description of this limited area may be applied to the whole of the range between the Burdekin and the coast—essentially a white granite, in which the mica is sometimes supplemented and occasionally replaced by hornblende, frequent bosses of intrusive pale pinkish felspar-porphyry (the felspar highly acidic), and occasional small areas of gneiss and mica schist, and of unmetamorphosed, or at least still recognisable shales and greywackes. The Black-and-White Hill and the One-mile Mountain, as well as the intervening belt of country, are of typical granite. The Brothers are composed of a very tough, dark-blue syenite, weathering black. Mount Marengo affords a notable example of the intrusive felspar-porphyry.

Most of the spurs on which the reefs occur drain northward into Marengo Creek, which joins Selina Creek near Marievale.

Marengo was opened up about 1871, but cannot be said to have, at any time, flourished. The claims were taken up, as a rule, by working miners, who found it impossible to repay themselves for their outlay in time and money without the intervention of the capitalist. The place, therefore, died a natural death before the completion of the initial stages of the work, when "backing" is indispensable. Whether with backing the field might have paid, is a question to be discussed after the reefs have been individually described.

I am indebted to Mr. D. Toomy for much valuable information regarding the history of the reefs, and for such other particulars as could not come under my own personal observation.

SEYMOUR'S REEF

Is situated on a ridge on the left bank of a gully which falls into Marengo Creek above Toomey's Camp. It runs west 11 degrees north and underlies to N. 11 degrees E. The country is hornblendic gneiss and mica schist and slate, with a north and south strike.

The reef was opened up in 1877, by James Seymour. He got 3 ounces of gold from a patch in a short drive into the hill (by hammering the quartz on a stone). From another drive, 20 feet lower, he got 8 ounces of gold, his crushing being done by the Albion Company's machine. The Albion Company joined Seymour, and sunk a shaft for 36 feet on the underlie. They took out 2 tons of stone, which crushed for 1 ounce $11\frac{1}{2}$ dwts. to the ton.

The

The reef occurs in bulges from a few inches to 1 foot wide. It is a cavernous quartz, with long thin crystals (hexagonal prisms). Crystals of copper pyrites are frequently imbedded in the quartz crystals, and the spaces between the quartz crystals are filled up with decomposed pyrites (brownstone) and yellow ochre. Joint surfaces are frequently coated with carbonate of copper. The reef adheres to the lower wall of a 2-feet dyke of syenite.

In Seymour's upper drift, a vein of hard white granite, 4 to 8 inches wide, follows the line of strike of the slates (north and south), and pierces the syenite dyke, but stops short on the upper side of the reef.

About 200 yards down the gully, D. Toomey and a few others have recently been sluicing. They got some coarse gold (largest nugget about 5 dwts.) pretty equally distributed throughout two feet of red sandy and clayey half-consolidated gravel, above a rocky bar. The surface of the rock (the bottom) is channelled into potholes, 6 feet deep and upwards, often full of large stones. The gold is very little rounded. It has a ragged scraggy appearance indicative of a large proportion of silver, and has cavities coloured brown from the decomposition of the formerly adherent iron pyrites.

VENTURE REEF.

About 200 yards up the gully on the left bank, the outcrop of the Venture Reef is visible. It is here white cavernous quartz with small hexagonal crystals. It runs W. 31 degrees N., and underlies at a high angle to the north-east. D. Toomey got 6 dwts. of gold in the gully about 100 yards below this. He also sunk a few feet on the reef near the gully, and got a little gold. The reef is only 8 inches wide at that place, with, however, a promising stone.

The reef is traceable across a ridge and gully to the west. On the left bank of this gully two shafts were sunk on the reef by the Albion Co. to the depth of 65 feet. D. Toomey made two crushings of the surface stone with his own small battery, the first giving 15 dwts., and the second, 7 or 8 tons, 8½ dwts. of gold to the ton. The next lot, 40 tons, was of mixed brownstone and mundic stone, from the lower levels, and was crushed at the Albion Co.'s machine for 3½ dwts. to the ton. The company then took 18 tons from a higher level, which gave 12½ dwts. to the ton.

In the brownstone of the footwall a red leader with kernels of blue carbonate of copper carried the gold conspicuously well. Some specimens are visible, of quartz mixed with brown decomposed pyrites and green carbonate of copper. This also carried some gold.

At the 65 feet level the brownstone was replaced by undecomposed iron pyrites with some copper pyrites. A little water was coming in from the footwall. The walls are said to have been well defined at the lower level, the average width of the reef being about 3 feet, with mundic mixed throughout. A "horse" of the country came into the reef at the mundic level, but seemed to be dying out in a drive to the westward. I took with me a parcel of mundic stone (very pale iron pyrites in minute cubes), and having picked it clean from quartz, Mr. Thomas Buckland assayed it, and reported that it contained 1oz. 6 dwts. 3 grs. of gold and 6 ozs. 12 dwts. of silver to the ton.

About 150 yards south of the Venture Reef, another reef crosses the ridge on which Seymour's mine is situated. The reef runs W. 11 degrees N. and dips to N. 11 degrees E. at a very high angle. Sometimes the reef is only represented by a 1-inch vein of reddish quartz. Where the reef bulges out, sometimes to 2 feet in width, the reddish vein keeps the footwall. At the opening of Marengo, D. Toomey and others "dolleyed" a little of the red vein, and obtained about 6 dwts. of gold to the ton.

On the left bank of the gully to the west of the Venture Reef, is another reef running, W. 4 degrees S. and dipping slightly to the north. A shaft, 10 or 12 feet deep, was sunk on the reef at the opening of the field and fair prospects were obtained by hand-crushing. The quartz has a good deal of brownstone.

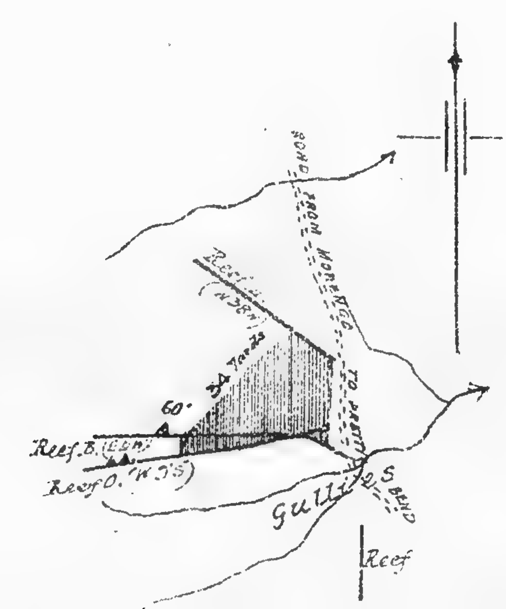
About 20 yards south of this is another shaft sunk for 50 feet on the underlie of a reef running west 6 degrees north, and hading to north 6 degrees east. It was sunk by the same party that sunk the last-mentioned, but I was unable to learn what success they met with. The reef is 8 or 9 inches wide, with a red leader on the hanging wall. Some of the stone is coated with yellow ochre, and contains brownstone and a little copper pyrites.

CALEDONIA REEF.

About a quarter of a mile west of the last-named workings, on the crown of a low ridge, is the Caledonia Reef. It runs west 1 degree north and dips to north 1 degree east at 55 degrees. The reef was worked about 1871. It is a mass of parallel quartz veins about 3 inches thick, with mullack (gangue) between. The quartz shows a moderate amount of green carbonate of copper, besides brownstone. The whole of the stone taken out was crushed, and gave 16 dwts. to the ton. One shaft was sunk 20 feet vertical and 40 feet on the underlie.

REEFS AND SURFACE WORKINGS ON PRETTY BEND ROAD.

At a point on the west side of the Marengo and Pretty Bend Road bearing west 40 degrees south from the West Brother, and west 38 degrees south from the Mid Brother, is the group of reefs delineated in the sketch-plan Fig. 4.



A is a large reef of white quartz, with joints stained with peroxide of iron. *B* is about 10 to 20 inches wide. It underlies at 60 degrees to the north, and has cavities well filled with brownstone. *C* is a vein of 1 or 2 inches traversing granite, or, more strictly speaking, a joint in the granite faced with small dog-tooth quartz crystals. D. Toomey got colours in *B*, but none in *A*. W. McDivott got specimens (quartz showing free gold) in *C*; one stone weighing 15 lbs., containing 14 ounces of gold. He washed 200 ounces of gold from two feet of surface on the top of the hill (the shaded portion in the sketch) about four years ago. D. Toomey afterwards got 100 ounces from the same place, and 4 ounces down the slope from reef *C*. Very little gold was got in the gully below *C*; but a good deal in the creek into which the gully empties itself. Down the hill along the line of the reefs *B* and *C* to their junction, the gold obtained from the surface was loose "reef-gold," very open and porous and quite unworn. Below the junction of the reefs "specimens" only were obtained—pinkish white rubble from the larger reef, specked with visible gold.

From the position of the auriferous surface on the top of the hill as well as from the unworn character of the gold, it is evident that the surface here was not washed from any distance, but resulted from the decomposition, on the spot, of the granite and the reef.

MANCHESTER REEF.

This reef lies on the top of a ridge at a point W. 34 degrees S. from the West Brother, and W. 12 degrees S. from the Mid Brother. It runs E. 6 degrees S. and dips to N. 6 degrees E. at 50 degrees. It was worked about eight years ago in an opencast 50 or 60 feet in length, and a vertical shaft reaching the reef at 40 feet in depth. In the opencast the reef was 5 feet wide in places and very white. At a greater depth it averaged 18 inches. The cap stone only crushed 12 dwts. to the ton, the next 16 dwts., and the lowest 18 dwts. A heap of about 2 tons of picked brownstone lying at the surface looks very good. The country is tourmaline-porphyry with a band of chlorite-slate underlying the reef. The quartz near the footwall and the footwall itself are a good deal stained with carbonate of copper, of which the slate also contains some specks.

The reef is traceable for nearly half a mile down the ridges to the west. At the end of the half mile a small opening was made in the reef (simultaneously with the Manchester workings), but no crushings were taken out. The quartz is a good deal stained with carbonate of copper. Some specimens of selenite stained green with carbonate of copper are also obtainable. This spot was marked out for a copper selection, as was the whole distance from here to the One-mile Mountain (about two miles). The proportion of copper is, however, much too poor to pay for extraction.

JAMES FRANKIE REEF.

Occurs on the top of a ridge at a point bearing W. 15 degrees N. from the Mid Brother, W. 1 degree N. from the West Brother, and E. 41 degrees S. from the One-mile Mountain. Its course is W. 41 degrees N. It is vertical, or nearly so. The country is grey granite, impregnated with carbonate of copper near the walls. The reef is quartz, varying from nothing up to 9 inches wide. It occupies the centre of a course of greywacke about 2 feet wide. The quartz is intersected by horizontal joints, and has vertical cavities parallel to the sides of the reef, lined with small crystals, the interstices being filled up with decomposed pyrites. George Dipple worked the upper part of the reef (opencast). He crushed 14 tons, at the rate of 12 dwts. to the ton. D. Toomey and others worked a lower level (15 feet), from which they took 5 tons, which gave them 7½ dwts. to the ton.

TOOMEY'S REEF.

This reef is on the top of the same ridge as the James Frankie. The place bears W. 1 degree S. from the West Brother, and E. 44 degrees S. from the One-mile Mountain. Its course is E. 8 degrees S., and its underlie 65 degrees to N. 8 degrees E.

The reef was opened up, in 1878, by D. Toomey, who sunk a shaft 50 feet down the underlie. It varies from 1 to 18 inches, and has a good deal of brownstone, derived from large crystals of pyrites, whose form is still recognisable. Quartz crystals, coated with crystals of specular iron, are common. The country is grey granite, specked near the reef with fine pyrites. The walls are stained with carbonate of copper. To the west of the shaft the reef splits up into two. Ten tons gave 1 oz. 2 dwts., and 2 tons 1 oz. 1 dwt. to the ton.

ALBION REEF.

This reef lies due west of the Mid Brother and S. 20 degrees W. of the One-mile Mountain (which is about a quarter of a mile distant across the valley). The reef is vertical and occurs on the crown of a ridge. Its course is W. 19 degrees N. The reef, where it has been left, is about 10 inches wide, and consists of a white quartz with ferruginous cavities. From a shaft about 50 feet deep some quartz, stained on joint-planes, with carbonate of copper, has been brought up. It is not richer in copper than several other reefs on the field, but it was taken up for copper at the opening of Marengo, and all the country between this and the Manchester Reef was pegged off for copper selections. Only 2 cwt. of copper ore were sent down, and are said to have yielded 11 per cent. of copper, besides gold at the rate of half an ounce to the ton. D. Toomey crushed one ton from the bottom level. It yielded 16 dwts. of gold. The country is grey granite.

REEFS ON ONE-MILE MOUNTAIN.

This mountain consists of coarse white granite; several reefs are visible all round it; some with very good-looking brownstone. One reef, on the tongue connecting the mountain with the table-land behind, runs N. 6 degrees E., and hades to E. 6 degrees N. A little opencast work has been done on it, and about six tons of stone are lying at grass.

About half a mile west of the One-Mile Mountain is a huge blow of white quartz. The reef must be at least twenty feet in thickness. It runs W. 21 degrees N., and hades to the N.E. at an angle less than 45 degrees. A few holes have been sunk on it, and some brownish stone has been taken out. Some specks of decomposed pyrites are seen.

REEF

REEF NEAR KILLING-YARD.

A few holes have been made on a reef north of Mr. Bode's old killing-yard. The reef runs North 6 degrees E. Some fair brownstone lies at the surface. I was unable to learn if any crushings had been made.

The alluvial gold found in the Marengo gullies has a very scraggy or ragged appearance, betokening a large amount of silver alloy; is pitted with red cavities, due to the decomposition of the pyrites with which it was originally associated in the reefs; and is very little rolled. Gold of this character is usually found only in the neighbourhood of the reefs, the finer particles which form the bulk of the gold in the reefs having been, as at Normanby, disseminated too widely to be ever collected in payable quantities. Alluvial gold found on the top of the tableland is said to be more waterworn, and in good "shotty" nuggets. Payable patches of gold are few and far between, both on the tableland and the underlying spurs.

Will they pay? is the great practical question that will be asked regarding the two goldfields above described.

The facts regarding Marengo are so distinct that little doubt can be entertained as to the answer. Any part of the Coast Range in which a group of reefs occurs is a goldfield in the same sense that Marengo is. A limited amount of gold is present in the reefs, associated with pyrites and (above the water level) with decomposed pyrites. The proportion is too low to cover the expenses of working while wages, rations, and appliances remain at or near their present rates. The situation of Marengo is about as favourable as could well be hoped for, with a good road to a port within 25 miles and machinery on the spot. When the conditions approach more nearly to those which obtain on some of the Victorian goldfields—a large population steadily employed in alternate reefing and lead-work, economical living, and machinery in constant employment—Marengo, and a dozen similar localities, will undoubtedly pay. The Marengo reefs are so closely grouped that a single set of first-class machinery would be sufficient for the wants of the whole district. One or two of the reefs are almost good enough to pay even now, but could not bear alone the whole of the expenses necessary to put the field in going order. A goldfield in its infancy offers an exception to the usual laws of trade. The mines must bear in common the expenses of the machinery, &c., without which they are themselves worthless. Instead, therefore, of there being a struggle for existence, each individual miner is directly interested in the prosperity of his neighbour.

Normanby ought to pay now. It will be answered, however, that it has been fairly tried, and has failed. This, however, is not so true as it appears at first sight. The field lived for about 18 months, and was killed by the removal of the crushing mill. It is quite true that the few hasty crushings taken out in that time did not in many cases repay the heavy preliminary outlays. The wonder is that they did in any case, but some of the reefs paid fairly well. In a few of the mines the mundic level was attained, and as there was no machinery on the field for treating stone of this class, the workings were promptly abandoned. The unusually rich assays of the mundic from the Just-in-Time and Welcome reefs warrant the hope, that at no distant date Normanby may again rank among the busy centres of mining industry. I do not, of course, predict that every reef will pay, which would be contrary to all experience, but only that the field ought to do well as a whole.

It might be impossible on the large scale to pick the mundic as clean as in the specimens assayed, or to extract the whole of the gold, but there is a large margin, and half the quantity contained in the Just-in-Time and Welcome mundic would be a good return.

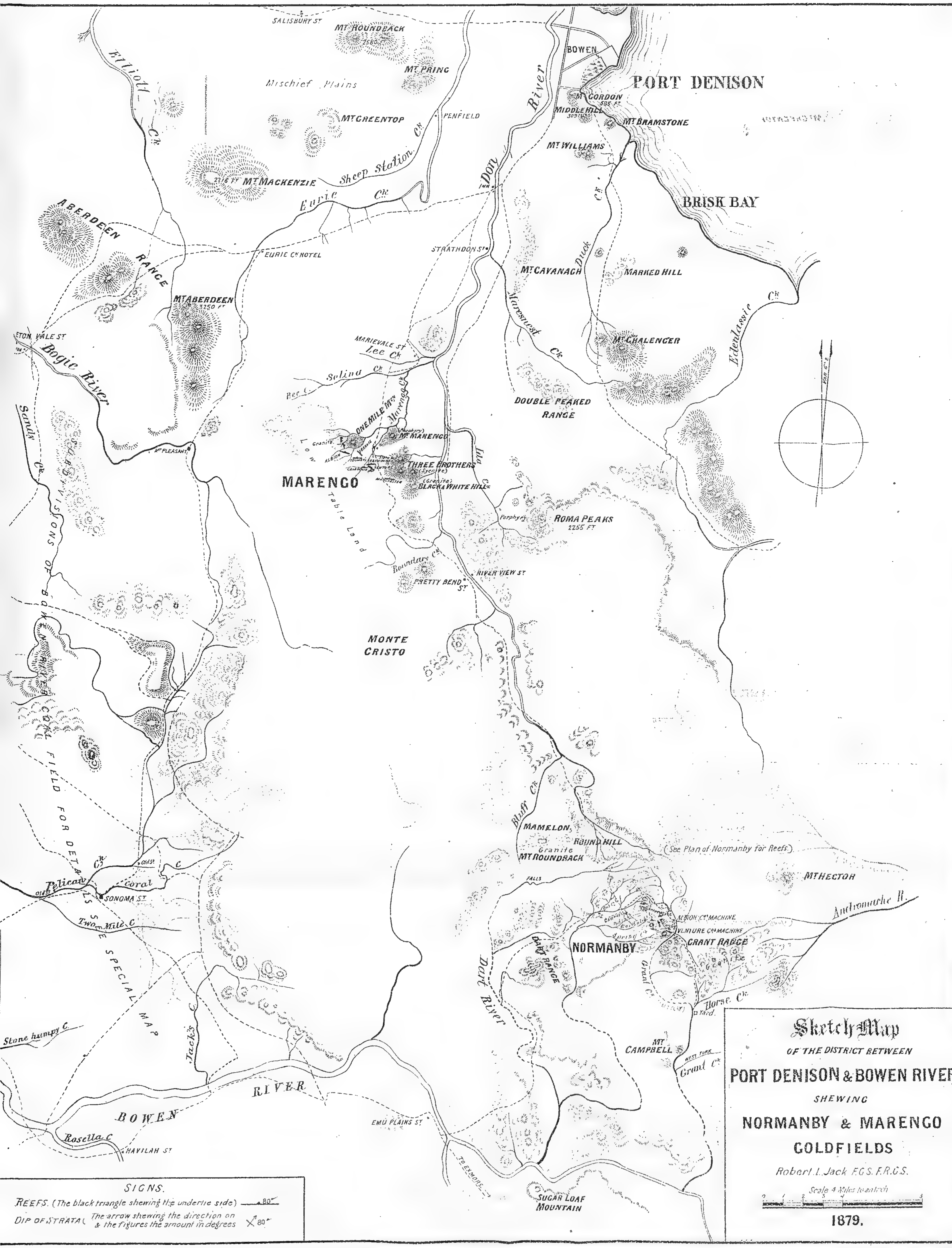
The metamorphic rock (tourmaline-porphyry), among which the Normanby reefs principally occur, is a somewhat unusual variety, and therefore we have few observed facts to guide us regarding the success of reefing in such country. In all probability the gold was precipitated simultaneously with the deposition of the original sedimentary rocks, collected together and associated with the pyrites when the metamorphism took place, and finally aggregated in the reefs.

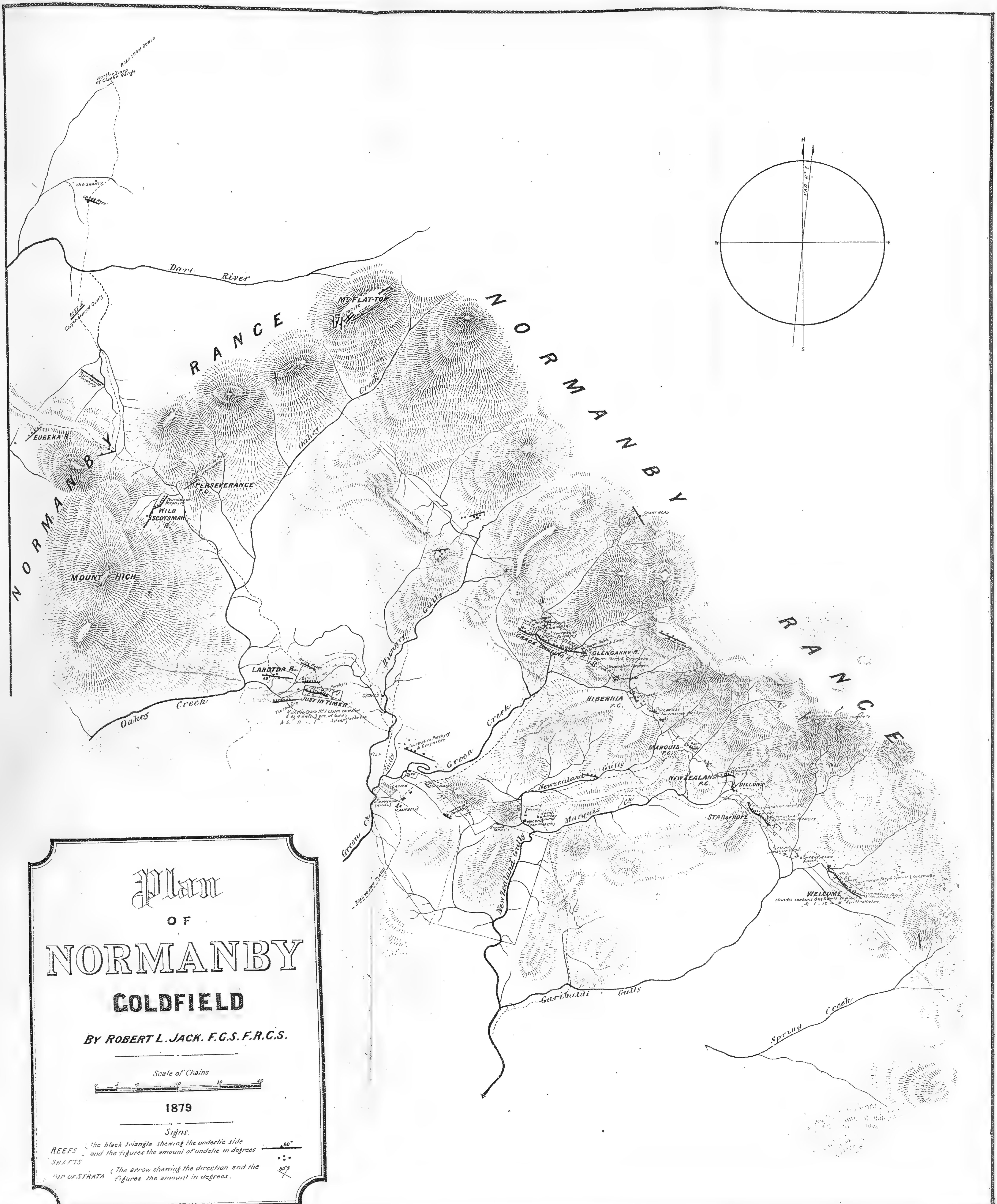
At present the mining population is limited to three men, who live in the hope of "dropping upon a patch" of payable alluvial gold. Their perseverance deserves success.

Townsville, 15th May, 1879.

Price 1s.]

By Authority: JAMES C. BEAL, Government Printer, William street, Brisbane.


Sketch Map
OF THE DISTRICT BETWEEN
PORT DENISON & BOWEN RIVER
SHEWING
NORMANBY & MARENGO
GOLDFIELDS
Robert L. Jack F.G.S. F.R.G.S.
Scale 4 Miles to an Inch
1879.
SIGNS.
REEFS. (The black triangle shewing the underlie side) 80°
DIP OF STRATA. The arrow shewing the direction on & the figures the amount in degrees 80°
PORT DENISON
BOWEN
MT GORDON
MIDDLE HILL
MT BRAMSTONE
MT WILLIAMS
BRISK BAY
SALISBURY ST
MT ROUNDBACK
2580
MT PRING
Mischief Plains
MT GREENTOP
PENFIELD
MT MACKENZIE
2216 FT
Sheep Station Ck
Elliott Ck
Eurie Ck
Don River
ABERDEEN RANGE
EURIE Ck HOTEL
MT ABERDEEN
3250 FT
STRATHDON ST
MT CAVANAGH
MARKED HILL
Duck Ck
Mavesnest Ck
MT CHALENGER
Edenlassie Ck
DOUBLE PEAKED RANGE
ETON VALE ST
Bogie River
Sandy Ck
MARIEVALE ST
Lee Ck
Selina Ck
Bee C.
Marengo Ck
ONE MILE MTN
MT MARENGO
THREE BROTHERS
(Syenite)
(Granite)
BLACK & WHITE HILL
Granite
ALBION
MARENGO
Low Table Land
Ida C
MT PLEASANT
Porphyry
ROMA PEAKS
2255 FT
Boundary Ck
PRETTY BEND ST
RIVER VIEW ST
MONTE CRISTO
SONS OF BOWEN RIVER COAL FIELD FOR DETAILS SEE SPECIAL MAP
Bluff Ck
MAMELON
ROUND HILL
Granite
MT ROUNDBACK
(See Plan of Normanby for Reefs)
MT HECTOR
FALLS
Andromache R.
ALBION Co MACHINE
VENTURE Co MACHINE
GRANT RANGE
Spring C
NORMANBY
Grand Ck
Horse Ck
Yard
Dart River
MT CAMPBELL
WEST FORK
Grand Ck
Pelican Ck
Coral C
CHAST C
SONOMA ST
Two Mile C
Stone humpy C.
Jack's C
BOWEN RIVER
Rosella C
HAVILAH ST
EMU PLAINS ST
TO EXMOOR
SUGAR LOAF MOUNTAIN
VAR 6°E



Plan
OF
NORMANBY
GOLDFIELD
BY ROBERT L. JACK. F.G.S. F.R.G.S.
Scale of Chains
0 5 10 20 30 40
1879
Signs.
REEFS The black triangle shewing the underlie side and the figures the amount of underlie in degrees
SHAFTS
DIP OF STRATA The arrow shewing the direction and the figures the amount in degrees.
NORMANBY RANGE
NORMANBY RANGE
Dart River
Oakey Creek
Oakey Creek
Green Creek
Green Ck
Hungry Gully
New Zealand Gully
Newzealand Gully
Marquis Ck
Garibaldi Gully
Spring Creek
MT FLAT-TOP
MOUNT HIGH
EUREKA R.
PERSEVERANCE P.C.
WILD SCOTSMAN R.
LAROTOA R.
JUST IN TIME R.
GLENGARRY R.
HIBERNIA P.C.
MARQUIS P.C.
NEW ZEALAND P.C.
DILLONS
STAR OF HOPE
WELCOME
OLD SHAFT
N
S
E
W

1881.

QUEENSLAND.

REPORT ON EXPLORATIONS IN CAPE YORK PENINSULA, 1879-80.

BY ROBERT L. JACK, GOVERNMENT GEOLOGIST.

Presented to both Houses of Parliament by Command.

TO THE HONOURABLE THE SECRETARY FOR MINES.

FIRST EXPEDITION.

In April, 1879, I was honoured with instructions from you to examine the Cooktown district with special reference to the existence of coal, and to report generally on the geology of the district.

Having devoted about three months to the coal question,* I deemed it advisable to visit some of the outlying parts of the district before the summer should be too far advanced, reserving the work in the settled parts for the season when the natural grasses of the country might be expected to prove inadequate to the support of the horses of the party.

The party comprised two white men (J. J. Macdonald and Charles Grainer), two black boys (Willie and Brusher), and the leader. In addition to the five horses required for mounts, five carried provisions, tents, blankets, ammunition, and tools.

The objects I placed before myself in setting out may here be briefly summed up: To traverse the little-known region north of the Endeavour and east of the Normanby Rivers, and to gain such an idea of its structure as might serve to throw light on its value as a possibly metalliferous country; to strike the blazed track leading to the Coen, the site of the brief, but vigorous, rush of 1878; to examine that locality, and, if practicable, penetrate a short distance further to the north; and, lastly, to note, on the way back to Cooktown, the geology of the district lying between the Coen and the Palmer Gold Field.

On the 15th of August, I left Cooktown and joined the rest of the party, who were camped, by previous arrangement, beside Mr. John Williams' station, on one of the heads of the Endeavour River. (Distance, 25 miles.)

On the 16th, we moved northward to the McIvor River [Camp 16,† distance 21 miles, in a general westerly direction], where we were joined on the following morning by Mr. Starcke, licensed surveyor, under whose guidance we continued our journey to his camp on the Morgan, distant 3 miles to the E.N.E.

From the starting-point at Cooktown an extensive view is obtained to the north and west, the valleys of the Endeavour and its tributaries forming a depressed foreground, which has the effect of throwing into strong relief the contour of the mountains beyond. No one can fail to be struck by the immense masses of horizontal sandstone strata which cap the mountains in continuous table-lands at the heads of the Endeavour and Oakey, and in isolated fragments at Cunningham's Range, Connor's Knob, and Cape Bedford. It must be obvious to the most superficial observer that the horizontal deposit must have been continuous at no very distant date even over the area where it is now only represented by fragments standing alone on pinnacles of slate or granite, and that the southern shores of the waters in which it was deposited were formed by the lofty ranges from which the Anan, Normanby, and Laura Rivers take their rise. North of this limit, or ancient shore, all the mountains which rise to the height of about 800 feet above the level of the sea "catch" (to use a graphic mining term) the even bottom of the sandstone, while from those which do not attain this altitude, as well as from the valleys, the deposit has been entirely removed by denudation.

With one notable exception, the sandstone, from the Byerstown Road northward to the Morgan, rests upon a foundation of nearly vertical strata of alternating slate, quartzite, and greywacke. A thick and valuable bed of limestone is crossed by "Coward's Track," between the head of Oakey Creek and, Mount Byerley. Should this limestone be traceable to the south, it may yet serve a useful purpose in defining the horizons of the accompanying strata. The edges of the slates and other upturned strata bear for the most part north and south. Southward on this line of strike the stratified rocks are at intervals metamorphosed into, or pierced by, granitic rocks. The auriferous districts of the Upper Normanby, Hodgkinson, and Mulgrave lie nearly in this line.

The exception referred to occurs in the valley of Oakey Creek, between the Palmerville and Byerstown roads. There the sandstone overlies, not the slates and quartzites, but a great thickness of strata containing *Glossopteris* (the characteristic fossil of the New South Wales and Bowen coal formations,

* See "Preliminary Reports of the Geological Survey of Northern Queensland": No 3, "On the Progress of the Search for Coal in the Cook District"; and No. 4, "Second Report on the Progress of the Search for Coal in the Cook District." Brisbane: By Authority, 1879.

† The consecutive numbers of our camps are here given, as they were conspicuously cut out on trees, and may serve for landmarks for a few years.

tions), and comprising sandstones, black shales, and coal-seams. This formation has already been described at some length in the two reports above referred to. The beds dip at high angles to the north-west, *under* the horizontal sandstone of the "Brothers," which is therefore separated from them by a violent inconformability. As a great thickness of the coal-bearing strata dips under the sandstone of the "Brothers" on the east side of that range, and *does not* reappear on the west side (where the sandstone rests immediately on slates), the coal-bearing strata must be bounded on the west by a fault which passes beneath, and does not disturb the horizontal sandstones. The *Glossopteris* bearing beds had been contorted, faulted, and denuded prior to the deposition of the still undisturbed sandstone—processes implying the lapse of an immense period of time.

The horizontal sandstone varies in texture from a coarse grit to a fine, hard, compact rock. The materials are for the most part siliceous, but occasionally felspathic. Generally white or yellow, they sometimes have a faint red tinge from the presence of peroxide of iron. Where much iron is present nodules of fine hematite are frequently met with. Pebbles of quartz, quartzite, slate, Lydian stone, greywacke, and granite occur near the base of the formation, forming a few beds of conglomerate.

In the far north of the Cape York Peninsula, as will be hereafter seen, the upper beds of the formation assume an entirely different aspect.

There are very few shaley beds among the sandstones. On the north side of the estuary of the Endeavour, however, some shales are seen crowded with plant *debris*. Indistinct plant remains have also been met with on Jones' Tableland. Thin (¼-inch) coal-seams occur on the North Shore, near Cooktown, and in Temple Bay.

On the 18th we left Mr. Starcke's camp, after improving a cutting through the scrub on the banks of the Morgan River for the passage of the pack-horses. This river and the McIvor are clothed with a luxuriant tropical scrub. Tall, dark trees throw a perennial cool shade over the rapid stream. Their dense foliage is pierced by no ray of light; but the slender stems of lofty palms shoot up through the leafy mass and wave their graceful heads above it. The spaces between the trunks of the larger trees are choked with a tangled mass of vegetation, including nutmeg trees, canes, plantains, the graceful but formidable laurier vine, and the large heart-shaped stinging tree, whose lightest touch is agonising to man and often fatal to horses.

A period subsequent to the denudation of the valleys in the horizontal sandstone has been marked by great volcanic activity, whose effects are seen in great masses of basalt. The basalt has emanated for the most part from volcanic centres, which occur generally in the form of dome-shaped unwooded eminences near the heads of the valleys, denuded out of the sandstone table-land. Conspicuous among these are the "Sisters," at the head of the Endeavour, the "Piebald Mountain," Mount Morgan, &c. These hills do not possess a crateriform appearance, but are mere rises marking the site of the lava-eruption which has spread around them when situated on level ground, or escaped in glacier-like *coulées* down the valleys. The points of eruption bear, in fact, such relations to the lava-flows as the similar *foci* in Auvergne bear to the basalt there. *Coulées* of basaltic lava have flowed from the *foci* above referred to down the valleys of the north and south forks of the Endeavour River, and have radiated out from Mount Morgan and other centres to the east and north over the flats between the mountains and the sea, where they form, by their decomposition, a chocolate-coloured soil of great depth, peculiarly fitted for tropical agriculture, and at present supporting grasses of very unusually fattening qualities.

Where the basalt has decomposed into soil *on the spot*, it gives rise to open, well-grassed country, almost bare of trees. But where, on the other hand, the soil has been re-deposited in alluvial flats on the sides of the river courses, it is usually darker in colour, and covered by the dense scrubby vegetation already referred to.

The surfaces of the basalt *coulées*, as well as of the dome-shaped centres of eruption, are frequently scoriaceous in a marked degree, forming spongy masses, light and porous as pumice-stone. In a few places the basalt of the *coulées* is columnar, as at the waterfalls in the Endeavour, between Williams' station and Branigan's. The basalt is of the usual character, but contains occasional hornblende crystals, and much olivine. It also contains lievrite (silicate of iron) in geodes.

Gates' Lookout is a volcanic centre of a different character—the deep-seated stump or "neck" of a crater, which once discharged showers of ashes from its mouth. It forms a conspicuous mountain of tuff, and can be seen from Isabella Creek to cut through the escarpment of a thick bed of white sandstone. The rock is an agglomerate of volcanic *debris*, with a certain rude bedding—courses of larger alternating with courses of smaller bombs—having a dip to the east at about fifteen degrees. That the bombs are not detached fragments of an already consolidated rock, but have been consolidated from a molten mass while whirling through the air, is proved by the spherical envelope of vesicular basalt which invariably enfolds them. The interior of the bombs is a mass of black and green crystals of augite (?) and olivine. They range from an eighth of an inch to a foot in diameter.

After skirting the east side of the Morgan Table-land (a denuded fragment of the horizontal sandstone) for a distance of about four miles, we ascended a "bald" (*i.e.*, treeless) mamelon near its northern extremity. This mamelon is another of the volcanic *foci*. A larger one—a low hill, partly scrubby and partly bald—rose from the flats about two miles to the east. From its base extensive volumes of smoke marked the whereabouts of a number of intending selectors who had left Mr. Starcke's camp in the morning, and were now burning the grass.

We next passed north-westward by the end of the sandstone cliffs of the Morgan Table-land, over slate ridges (below the level of the base of the sandstone) strewn with fragments of white quartz. In about two miles to the north we crossed from the left to the right bank of a stream running south, and about three yards wide, which must be a feeder, if not the main head, of the Morgan. It was fringed by a belt of scrub, through which we had to cut a passage with tomahawks. We followed up the right bank of this creek to the north for rather more than two miles, crossing a tributary coming from the hills to the west. At the end of the two miles the creek was found to trend to the west, the valley presenting a steep wall of sandstone, which forbade the further passage of horses in that direction. We therefore crossed to the left bank in the hope of finding a passable gap through the sandstone range further to the north. After skirting the range to the east and south-east for three miles, we camped on the left bank of a brook near the base of the range. [Camp 18; bloodwood, broad-arrow J 18.] The country passed over in this day's march was all slate, the slates being capped to the right and left of our course by horizontal beds of sandstone.

About

About 11 o'clock at night, Macdonald and the two blackboys heard one of the horses neigh suspiciously, and (as they believed) they heard a blackfellow among the horses signalling to his companions by a low whistle. On the alarm being given, we fired a shot in the air to apprise the visitors that we were armed and on the watch. The night was so dark that a sally would have been useless. Perhaps the shot had the desired effect, for we found the horses unhurt in the morning. The blacks in the Endeavour and McIvor country have a bad reputation, their weakness for horseflesh rendering them undesirable neighbours.

On the morning of the 19th we struck out eastward for a "bald" rise about three miles off—evidently one of the volcanic centres. We expected to be able to discover from this rise some gap in the sandstone range, but we were disappointed in reaching it, having to turn back with one horse lamed and the rest "cowed" by the attempted passage over what appeared, at first sight, an easy grassy plain. This turned out to be a marshy "devil-devil" country—probably a lake in wet weather—a network of boggy ditches, with the intervening dry stools of clay, covered with coarse, rank grass, through which it was very difficult to push one's way even on foot. I concluded that nothing but very urgent business would warrant my forcing a passage through this sort of country. Between the "devil-devil" and the sand-hills of the coast the natives were busy burning the grass.

Having retraced our steps to near the precipitous cliffs of the sandstone range, we skirted the latter for about three miles to the north and four to the west-north-west, when we passed through a gap and dropped down into a fair valley, about a mile in width, opening out to the north. We camped on the right bank of a creek of the third magnitude *—dry with the exception of a few waterholes. [Camp 19; bloodwood marked broad-arrow J 19, 79.] The valley, though it has not the rich soil and luxuriant grasses of the McIvor, has a fair patch of level grassy country, about two miles in length and a mile broad.

The north-eastmost promontory of the sandstone range passed in this day's march is very conspicuous from the McIvor and Morgan valleys. The lower beds of sandstone appear to rest on porphyry.

The gap, by which we dropped down into the valley where we camped, was not more than 300 feet above the sea-level. It was composed of slate and greywacke, with some crystalline quartz marked with reddish spots (decomposed pyrites). For about three miles further to the north, the slate and greywacke rose into little hills (forming the right wall of the valley in which we camped), but not to a sufficient height to "take on" the sandstone, which has been here entirely denuded.

Having disposed the camp to my satisfaction, I returned to the gap with Macdonald, who bottomed in a likely gully. The bottom was found to be decomposed greywacke, and the washdirt included fragments of prophyry, greywacke, granite, slate, and quartz. We found no gold.

After sunset we heard natives talking near the camp, but could not see them.

August 20.—We left Camp 19 at 8 a.m., and crossed the creek to a point about a mile to the north-west where the left wall of the valley dropped down to low ridges. Here we emerged from the valley, and pursued our course to the north-west for about two miles over low spurs of the range—slate and conglomeratic greywacke. These stratified rocks are nearly vertical, and strike north and south. The edge of the sandstone is distant about five miles to the south. There is a good deal of white quartz on the ridges, with crystalline cavities and a little "brownstone," or decomposed pyrites. We washed some dirt from cavities in the slate, but found no gold, nor even iron-sand or garnets.

From the left wall of the valley which we left in the morning, I took a series of bearings to recognisable points on the coast. I could see several large inlets of the sea to the north and north-east, and a lagoon situated about half-way to Cape Flattery.

We then held for about four miles to the west, at the base of a range (on our left) composed of conglomeratic slates and pale, blue, flinty mudstone. The natives were burning the grass, on a large scale about a mile to the north. At the end of the four miles the range was found to swing round to the north, and to extend in this direction for six or eight miles, and as this lay across our path we sought for a gap and found one (about 400 feet above the sea-level), which took us down into the next valley. The ascent was very trying to the horses, two of which showed signs of giving in. From the saddle of the gap (slate with a meridional strike) a good view was obtained to the north and south, and a series of bearings was taken. To the north we saw fair, open, country, about a mile in breadth, skirting the hills. Thence to the coast, however, the land appeared to be worthless—saltwater inlets, and bare "salt-pans," with a fringe of sand-hills.

On the inland side the gap overlooked a valley falling to the north-west. This valley is about a mile wide. We could trace it upward for five or six miles by the smoke of natives who were burning the grass—the alpha and omega of their simple notion of "doing their duty by the land."

We descended about a mile to the west into the valley, and crossed to the left bank of a creek. This was a deep, clear, running stream, two or three yards in width, flowing over a bottom of vertical slates, striking north and south. From the point where we crossed, the creek runs west. We followed down the left bank for about a mile, when, after rounding some slate spurs, which here come down to the creek from the sandstone table-land to the south, we found that the creek was a tributary of a much larger stream coming from the south. This river I named after Mr. Alfred Starcke whose surveying camp was at that moment the north-most outpost of civilisation in the interior of Queensland. It has a rapid stream about ten yards wide. Its bed is somewhat scrubby. A black gin was surprised beside a fire in the scrub as we crossed the stream. She seemed astonished, but not much alarmed.

We could see up the valley of the Starcke River, to the south, for eight or nine miles. The valley is nearly flat, with an average breadth of two miles of tolerable grazing country, lightly timbered with box and bloodwood. With the tributary valley it would form a fair-sized cattle run.

We continued our journey to the westward, keeping the river in sight, to our right hand, for the first mile or two; here we crossed a native track in the long "sorghum grass," only a few hours old. The travellers' line of march had been to the south. Their numbers must have been very considerable—I should say hundreds rather than scores—as the grass was beaten down as if by the passage of a large mob of cattle. About four miles from the crossing of the river we camped at sunset on the left bank of

* Some system of classifying creeks being absolutely necessary, I divide them into four magnitudes. The first comes next to a river, while the fourth is a brook. The magnitude refers to the place where the creek is crossed or described. A forth or third magnitude creek may, of course, become a river if followed down.

of a gully (a tributary of the Starcke), with waterholes and coarse grass. [Camp 20; bloodwood marked broad-arrow J XX]. We were overjoyed to find this patch of grass before night set in, as the last three miles of travelling had been over the still smoking embers of the bush fires we had seen in the morning, and we had begun to fear having to camp without any food for the horses. This would have been a serious thing in the weak state of some of our horses.

A gin and picanninny walked leisurely away from the right bank as we approached the gully. Brusher wanted to take possession of the gin, but I put my veto on the first proposal to adopt a course which has, again and again, been a fruitful cause of trouble between whites and blacks.

August 21.—On leaving Camp 20, we travelled northward for about two miles to a low range which extends three miles further north. As we did not cross the Starcke, that river must flow to the north, between the "low range" and the range which we crossed by the gap on the 20th August. There can be very little doubt that it enters the sea between Red Point and Murdoch Point.

We then struck W. 36 degrees N. (true) for a bold cliff of sandstone capping the mountains on the left, distant about six miles. Our course lay along the chord of a bay in the sandstone-capped range. The country passed over was nearly level, and timbered with bloodwood and box, with poplar-gum and Moreton Bay ash in the alluvial bottoms. There were no creeks of any importance. One mile short of the bluff, in crossing some protruding spurs of the range, we observed a large reef of poor, white, unpromising quartz.

At this place we were under the necessity of abandoning to her fate a piebald mare, which had become incapable of keeping up with the others. The black-boys had walked by turns since the morning, and the unfortunate beast had managed to keep up with the rest for a time. Then the empty saddle was found to be too great a burden, and was packed on another horse. But latterly she was too weak to go on, even with one man leading her by a halter and a black-boy urging from behind. On weighing the value of our time, the distance we had to go, and the limited quantity of our rations against the value of the animal, I had no hesitation in leaving her behind. My first impulse was to shoot her, to prevent her falling into the hands of the blacks and helping to spread the taste for horseflesh among the latter, but I let her go, on the forlorn chance of her recovering, and finding her way back to civilisation.

The sandstone at the bluff rests on granite. I ascended a spur leading up to the sandstone, and took a series of bearings. There is a belt of good country at the base of the hills, about five miles in breadth. No elevation of any consequence, except sand-hills, intervenes between the sandstone range and the coast.

We kept the same course (W. 36 degrees N.) over tea-tree (*melaleuca*) ridges (granite and slate, with quartz) for three miles further, when we obtained a view to the south up a large valley intersecting the sandstone table-land. We then struck magnetic west (W. 6 degrees N., true), and in one mile came on a large creek with numerous sandy channels—a running stream two or three yards wide, and deep waterholes. This creek had large tea-trees growing in its bed, and presented a striking contrast to the scrub-matted watercourses to the north of Cooktown. The obvious explanation was the poverty of the sandy soil.

Camped on the left bank of the creek. [Camp 21; Moreton Bay ash, broad-arrow J 21.]

In the course of the day we passed two native camps in the open country. One had evidently been abandoned only a few days before; it was merely a ring of boughs for a breakwind and the usual cooking-holes. The other was of more substantial bark "gunyahs," supported on pegs.

August 22.—We steered magnetic west on leaving Camp 21, for the first mile and a-half over flats with sandy soil, and for an equal distance across tea-tree ridges (spurs of the hills forming the left wall of the valley of the creek at Camp 21). In three miles from the camp we were on the saddle of a low gap in the sandstone wall. The gap showed slates and porphyries strewn with small quartz fragments. Three miles further west, through similar country, with sandstone cliffs capping the mountains to the north and south, brought us to the left bank of a running creek flowing south, with several sandy ridges in its bed; it must be a tributary of the creek that we left in the morning.

On the same course we travelled for four miles further through a poor, desert country, the bottom being re-cemented granite and sandstone debris, giving rise to a soil only capable of supporting stunted brushwood and poor, wiry grass. When sunset brought with it the necessity for camping, we managed, after much search, to find two muddy waterholes in a marshy bottom, and pitched our camp beside them. [Camp 22; stringy-bark, broadarrow J 22.]

Another horse had been found early in the day to be on the point of knocking up, and I reluctantly made up my mind to stay two days at Camp 22 before attempting to cross the ranges ahead of us. It was a pity that the grass and water were not of better quality than they were at our enforced halting-place.

The following morning (*August 23rd*) Macdonald and I walked into the next valley by a gap in the mountains, below the level of the base of the sandstone. The ridge we crossed was of slate, as was also the valley to the west. We carried prospecting tools, but as we found no water, they were of no use to us. On my way back to the camp I ascended the sandstone range to the north and had a long look ahead. After six or eight miles of mountains the country to the west appeared to be low and gently undulating, and I congratulated myself that our difficulties in crossing the range were nearly over. I could see the sandstone ranges extending a long way to the north, to a point which cannot be far from Cape Melville. Looking back on the line of our last march, the blacks were seen burning the bush about three miles to the east of our camp.

In the afternoon we prospected for some time (without success) in a running creek which we found about two miles south of our camp, and which took its rise in the sandstone ranges to the south.

On our return to the camp we were glad to find that the boys had shot a young kangaroo and two black cockatoos—a supply which would enable us to spare the salt beef for two days. A kangaroo dog which accompanied us turned out quite useless, a mere *bouche inutile.* The poor dog's worthlessness was explained afterwards by his falling into the distemper.

August 25.—Having previously determined on the best possible crossing of the range before us, I led straight up to it (north 24 degrees west, 1 mile). The best was not very good; it was up a long, grassy spur, leading to the lowest part of the range, at a height of about 500 feet; the descent on the other side was much steeper. The horses behaved well. A series of bearings was taken from the summit.

Having

Having descended into the valley (about a mile from its head), we struck out for a prominent point of the right wall of the valley, distant about three miles, and bearing west 14 degrees south. To the south of this point a long valley opened out, and this I took for the course of the creek; my surprise was great to find that it was only a tributary valley, and that the main stream—which I named Desert Creek—escaped westward through a narrow gap into the flat country which I had seen from the summit of the ridge. We were therefore fairly launched on waters flowing to the Normanby River or into Princess Charlotte's Bay, and had crossed in the morning (without suspecting the fact) the last ridge of the backbone of the Cape Melville Peninsula.

We continued down the valley for one mile to west 14 degrees north, and for three miles further to west 6 degrees north (the creek having by this time become a running stream). The last course brought us to a low sandstone range, which we had to skirt for two miles, to south 4 degrees west, before we could round it and continue our westward journey.

When we had rounded the point of the sandstone range and resumed our course (west 6 degrees north) we entered at once on a desert. The creek fell away to the south of our course, and the ground we traversed had an almost insensible southward slope. No more landmarks were visible than if we had been out on the open sea. There was no grass but spinifex, and not much of that, for the natives had burned it the day before. The timber was stunted tea-tree (*melaleuca*), stringybark or messmate, and low bushes of pandanus, occasionally thickening into scrub. There was no soil, but only deep white sand, derived from the waste of the desert sandstone. There were even no watercourses—what represented them were mere stripes of sand absolutely bare of vegetation, but not below the general level. After crossing about 8½ miles of this desert we found water at 5 o'clock—to my surprise, for I fully expected to have to make a waterless, and, still worse, an almost grassless camp. Beside the waterhole the natives had been manufacturing spears a few days before. [Camp 23; box, broad-arrow J 23.]

August 26.—The horses had gone back a good way in the night, owing to the poorness of the grass, and it was about 9 o'clock before we made a start. In ten miles (west 6 degrees north), through desert country exactly like that of the previous day—the last four miles rather harder ground, with occasional outcrops of sandstone and conglomerate—we came again on Desert Creek,* here flowing to the north-west. Having crossed to the left bank of the creek and continued on our course for about a mile further, we found some grass and water in a marshy bottom, and camped for the night. [Camp 24; bloodwood, broad-arrow J 24.] There was a thunderstorm, with heavy rain, during the night.

August 27.—Having dried our tents we continued on the same course. In eight miles we came on two gins carrying a baby—mother, daughter, and grandchild, probably—the first natives we had seen near enough to speak to. The elder woman was hideous by nature, and was rendered still more so by having her cheeks daubed with clay. The best that could be said of the younger was that she was less repulsive. She wore a fringe about four inches square, but her mother had no covering but mud. They were very much scared at first, but soon became very loquacious. Neither of our black-boys understood a word of their language. We made known by signs our anxiety to find water, and the gins pointed to the west. As the gins had more luggage than two could carry, they probably had companions who may have seen us and hidden themselves. We had the curiosity to overhaul their swags, but I was careful that the boys should take nothing. They had a well-made fishing net and line, about a score of long, thin bamboos for making fish-spears, and a net full of miscellanies including two old jam tins, some sea-shells (for drinking cups), and part of an old tent or fly. The European articles were probably spoils from the deserted Coen Diggings. I was interested in seeing that the gins had distinctly the instinct of sexual modesty, as they kept getting behind trees and hiding behind one another during their parley with us. When we turned to leave they followed us, till we warned them that we did not desire their company. They seemed pleased at getting permission to retire, and I fancy they had in some way fancied that they were bound to follow us as prisoners of war.

A low, table-topped hill of sandstone now appeared about a mile ahead of us, to west 26 degrees north, and I made for it in order to have a look-out for landmarks. We had scarcely started when Macdonald informed me that two of the horses were getting weak, while a third had fallen a long way behind, was in a lather of perspiration, and could hardly be pulled and pushed along by Grainer and Willie on foot. They had taken off his very light pack and put it on another horse. I was under the impression that the horses must have eaten some poisonous grass or herb. The superiority of such of the horses as have youth and breeding on their side comes out conspicuously in such strait as we were now in. Not much could be expected of the best of them, however. The country we had travelled over for three days was nothing but a wooded Sahara. The blacks had just burned what grass it usually bears. Once in ten miles or so we crossed a wet bottom with a little grass which had escaped the fire. But for these grassy patches the horses must have died of starvation.

It will be readily understood that I gazed from the hill with feelings of considerable anxiety for some sign of a change in the nature of the country. Westward (our proposed course), as far as the eye could reach, nothing but low, flat land was to be seen, and there was nothing to indicate an improvement in the character of the vegetation. With a heavy heart I admitted that to carry out my programme had become impossible, and made up my mind that the first thing to be done was to find water and camp, to save the failing horses; and the second, to strike the Normanby River or the Coen track, and go back to the nearest point of the Palmer road, spell the horses, and perhaps buy a few more to replace those that were unfit to travel.

Turning to the south-west (magnetic), in which direction I hoped to find the Normanby at its nearest point, we came in one mile to a waterhole in a sandy gully, with a little green picking for the horses. [Camp 25; Moreton Bay ash, broad-arrow J 25.]

August 28.—Left Camp 25 at 8 a.m., and kept (magnetic) south-west. In two miles we reached the Normanby River—a magnificent sheet of deep water a furlong or more in breadth, flanked by chains of lagoons, with sweet grass and a sort of four-leaved clover which the starving horses attacked with great relish

* In a school map issued by the Department of Public Instruction, this creek is named "Jack River." The mistake must have arisen from my route having been marked as parallel to the creek in a MS. map showing the courses of the various explorers.

relish. Hope revived, for I could see that a few days' rest and feeding here might be the salvation of the poor beasts of burden. We camped on a lagoon on the right bank of the river. [Camp 26.] In the afternoon we caught some fish, and the black-boys shot two pelicans, which we ate thankfully.

Grainer had been, in 1878, part of the way to the Coen rush, and described the blazed track as crossing the Normanby five miles below Battle Camp, and keeping the right bank of the river for thirty miles more, to what is called the lower crossing. As we had not crossed the track, we had struck the river below the lower crossing. I therefore determined to run the Normanby up to the lower crossing, a course which would bring me nearer the Palmer road should I find it necessary to return.

Half-a-mile above our camp there had been a native fishing station last wet season. The mouth of a gully (still retaining a few waterholes) had been stopped by a fence of stakes and twisted branches The blacks must have got a good many large barramundi, judging from the heaps of large scales lying about. Six dome-shaped gunyahs, four feet high and six in diameter, were still standing. They were strongly built of flakes of tea-tree bark, secured with vines and tea-tree bark ropes to a framework of boughs. Every cranny was carefully stopped up with straw. The access was by a door fourteen inches square, stopped up with a wisp of straw. A heap of ashes lay inside each gunyah, opposite the door. I thought the buildings were designed for smoking fish, but the boys assured me they were only for protection in the season when "bigfellow rain come up." It is an undeniable fact that Queensland natives can live where white men would be suffocated.

The next day (August 29), Brusher and Willie having been sent out with a shot-gun and rifle to get game and report if they saw the Coen track, were attacked by natives while eating their lunch, about five miles down the river. One spear (barbed with kangaroo bone) lighted at Willie's feet, and a fishing-spear (a bamboo lance with four bloodwood prongs), broke in a tree above his head. The boys saw five natives in all, two of whom they shot dead—one of them while in the act of aiming a spear. The rest fled. Such, at least, was the boys' story, and I failed to shake it in any essential point by a long cross-examination. They brought home two spears in support of the story. I regret the circumstance, as I hoped to accomplish my peaceful mission without bloodshed; but I could not blame the boys for doing what I should have done myself had I been attacked.

In view of possible retaliation we kept a watch all night. It was clear moonlight, and it would have been easy for the natives to track the boys to the camp and treat us to a camisade. I did not doubt our joint ability to defend ourselves, but what was to prevent the natives wreaking their revenge (as is their custom) on the horses feeding out of our sight? Brusher insisted that the blacks would not start in pursuit till they had eaten the last of their two friends. We were not disturbed, which gives a colour to this theory, but my mind was not so easy as Brusher's. The boys, who do not usually watch with a good grace, were on the alert all night, even when "their watch was below"—a circumstance which I think corroborates their story to some extent.

August 30.—All the horses have much improved at this camp except two of the packers (Billy and Queensland); Billy, in fact, looks more wretched than ever. I fancy he has eaten some poison bush.

We left Camp 26 and held our way up the right bank of the Normanby (south $16\frac{1}{2}$ degrees east, true). We soon entered on a low, flat country, and our path lay across this for three miles. In the wet season, when the river overflows, this flat must stand as a lake for some months. The trees (*melaleuca* and Moreton Bay ash) were crusted with fine muddy sediment over our heads as we rode. The soil was a stiff, dry-baked clay. This is evidently the very place where Hann struck the river when he discovered it in 1872. In a mile and a-half more on the same course, over undulating country, we came to a low ridge from which we could see a sandstone range about ten miles to the east. This range was visible from the sandstone hill I ascended on the 27th.

In three miles more, on the same course, we passed a broad swamp on the right alive with geese.

Four miles more, over rather flat country, recently burnt, with large bloodwood and box trees, with recent conglomerate occasionally visible, brought us again to the Normanby. We camped on some fine new feed between the river and a chain of lagoons. [Camp 27.] Although this camp is higher up the river than that of the previous day, the river is four times as wide—a truly magnificent sheet of water.

August 27.—Leaving Camp 27, we continued up the right bank of the Normanby—a broad sheet of deep water flanked by scrubby alluvial flats. Our course lay E.N.E. for one mile, S.E. one mile, and east (magnetic) one mile. At this point there are rapids with a drop of about 6 feet over a recent conglomerate or "cement" bed. Above the fall the sheet of water is at least a quarter of a mile in breadth. The banks are lower than below the fall, but except on the marshes and lake bottoms we passed yesterday there is no sign of the country being subject to floods. Just above the fall the skeleton of a crocodile was found on the top of the bank. In one mile more (magnetic east) we left the Normanby and followed up a branch of the river for one mile further to magnetic east, four miles to magnetic south-east, one mile east (true), and one mile magnetic north-east. By this time it became evident that we had left the main river and were following a tributary rising far to the east and draining the south side of the sandstone mountains which we had lately crossed. The creek had a rapidly running stream equal in volume to the Endeavour River at Webb's Crossing. It had a sandy bed, with the tea-trees and Moreton Bay ash, characteristic in this latitude of large watercourses in poor country. The banks of the creek were choked with brushwood and very poorly grassed—a marked contrast to the fertile banks of the Endeavour. We crossed to the left bank, and found that another river of equal volume was flowing in the same direction within a quarter of a mile. We camped between the two. [Camp 28.] I learn from Hann's journal that he made the very same mistake that we did in following this creek up under the impression that it was the Normanby. The keen eyes of the black-boy saw the place where we left the river, but I was not informed of this till we had camped.

September 1.—We left Camp 28 early in the morning, and, having crossed the southmost creek, struck due south. In half-a-mile we came to a long lagoon stretching east and west, and after heading it (half-a-mile east) continued on our southward course. In four miles, across rather barren country, with bloodwood and ironbark timber, we passed by the east end of another large lagoon. In a quarter of a mile more a third-magnitude creek was crossed, running west, and in half a mile more we struck the Coen track. For the last three or four miles of our journey we met with abundant evidence of the recent passage of a large number of natives.

After

After a hurried consultation with Macdonald and Grainer regarding the condition of the horses and the quantity of our rations and ammunition, it was agreed that the horses *might* carry us through, but that we should have to go on a short allowance of the necessaries of life, trusting to eke out the quantity with game. The task we set before ourselves was an arduous one, but one and all cheerfully accepted the risks and privations rather than go back baffled.

The track which we followed from this point to the Coen diggings turned out to be in places very indistinct. It was difficult to believe that not much more than a twelvemonth ago two thousand horses had beaten it. A line of trees was marked, but it was sometimes "a far cry" from one blaze to the next.

In two miles north-north-west we passed a large lagoon on the left. Five gins were surprised here engaged in digging lily-roots on the edge of the lagoon. They ran away at first, one gin leaving her child behind, but they shortly approached and jabbered volubly. The women had straight hair. One of them had a child about three days old, and it was interesting to note that it was marked with the boiled-lobster tint common among white children of the same age. The women stood in line and pointed with their left hands along the track, reminding me of the witches in "Macbeth." They were understood by the boys to mean that their men were in that direction, and that we should go another way to avoid a collision. One gesture of the weird sisters surprised and puzzled us all. All at once each caught hold of her breasts and squirted milk towards us in copious streams. Perhaps they meant that they were entitled to our consideration as women and mothers. The party we met before had distinctly a sense of modesty, but this party had absolutely none; so that I am still unable to say, from my own observation, whether modesty is an instinct in the unsophisticated orders of mankind, or an acquired habit of mind.

In half-a-mile more we came on a man cooking at a fire by the side of a lagoon. He ran away like a deer and hid among the reeds, leaving his all behind—some eggs, some roots, an opossum just singed, a spear and wommerah, and some bamboo fishing-spears. A snake was roasting on the ashes.

The track kept a general north-north-west (magnetic) direction. For the first two miles it wound among lagoons, with fine green picking for horses. At the end of the two miles the Normanby came in sight. For the next four miles (to the "lower crossing") we passed through poor bush country parallel with the river. The trees were frequently crusted with muddy sediment above the blazes, which were at the height of a man's hand on horseback. This part of the road must be deeply submerged during the wet season. The track was very hard to follow and we often missed it.

We crossed the river at the lower crossing, and camped on its left bank beside some lagoons where there was sweet young grass for the horses. [Camp 29; bloodwood, J, 1/9/79]. The track crosses the river by a conglomerate bar which dams back a long reach of deep water. In view of the proximity of natives—probably in large numbers (for we saw many fires among the lagoons)—we kept a watch all night.

September 2.—Leaving Camp 29 we kept (by the track) magnetic west through good level country with pretty good feed—the grass having been burnt about three weeks before. In two miles we reached a large second-magnitude creek, with a bottom of recent sandstone or "cement," said to be the Laura. What are called the Laura and the Kennedy, on the Coen track, are said to have been traced from the Palmerville and Cooktown road by parties running them down to the Coen diggings; otherwise I should have said that the creek now crossed was not half the size the Laura should have attained after travelling so far.

The next five miles were over low, level country, for the most part bare of timber, there being only a few stunted Moreton Bay ash trees scattered about. Little lagoons are frequent, and abound in native companions and geese. The whole of this country had been recently burned, and carried rich green grass. We resolved to spell the horses here for two days. Queensland and Billy were both picking up, and Coen had now little the matter with him. Two days on these fertile plains should set the horses all up for a time. This country would make a few good cattle runs. The subsoil is a grey, friable loam. The land is not subject to floods, although most of the open plains must be swampy, and perhaps covered with a few inches of water in the rainy season.

We camped beside a lagoon where Granier said game of all sorts abounded at the time of his former visit. We were less lucky. Brusher managed to bag three parrots and two teals at the expense of a great deal of ammunition. The fact that the last of our beef was "on the table" at supper-time gave us a keener interest in the shooting than that of mere sportsmen. [Camp 30; Moreton Bay ash, J, 2/9/79.] I fixed the latitude of this camp at 14 degrees 57 minutes 49 seconds S. This was the first reliable observation taken as hitherto; the nights had either been too cloudy to see the stars at their transit, or the moonlight had made the reflection in the mercurial horizon indistinct. On the coast side of the range this mattered little, as I was generally able to determine my position by bearings to points on the coast.

Just as I had finished my observations, a sudden stampede among the horses convinced us that the blacks were disturbing them. They snorted and capered about in a state of high excitement and alarm. We sallied out armed, but saw no enemy, and found the horses unhurt after we had with great difficulty collected them.

September 3.—When the boys were mustering the horses in the morning they heard the voices of natives. This rendered it probable that the natives really had a look at the horses during the night. As we could not afford to lose another horse, we abandoned our intention of spelling the horses here.

We left Camp 30 at 8 a.m. The track, which is here well defined, keeps magnetic west. In one mile the soft-soiled plain-and-lagoon country ended, and was replaced by gently-rolling, hard-bottomed, open forest land strewn with little pebbles (coated with iron-oxide) from the recent conglomerates. The trees were mostly bloodwood. In half-a-mile more the loamy soil reappeared, with small lagoons and a few open plains—rarely swampy. The grass had been burned about three weeks before, and there was abundance of short, sweet grass.

Four miles from the camp we passed a little lagoon on the right hand, with the ridge-poles and pegs of a tent still standing. Just beyond this lagoon the track bends to magnetic north-west. In two miles a large swamp was passed on the left with geese in great numbers. In one mile further we passed a tree marked broad-arrow over 120 on the right-hand side of the road, by the edge of a chain of lagoons.

In

In half-a-mile more Macdonald brought down an emu with the Snider on a large open plain. It supplied the camp with fresh meat for three days.

Two miles further we passed a large lagoon on the left. In two and a-half miles more a lagoon, abounding in white geese and pelicans, was passed on the right side of the road in a wide open plain.

In two and a-half miles we reached the Kennedy River running north and camped on its right bank.

From the Emu Plain to the Kennedy the country is alternately open forest and unwooded plains. The timber is well grown, and chiefly consists of bloodwood, with a sprinkling of box and Moreton Bay ash. The plains are studded with gigantic white ant-hills, and look like graveyards. The boys killed a large carpet snake at the camp.

The Kennedy is a most disappointing river. It is difficult to realise that this insignificant dribble of water is the river named after the unfortunate explorer who followed its course five and thirty years ago. It has a single narrow channel with a rivulet meandering through it, and has no scrub on its banks. A single large tea-tree overhangs the right bank and bridges the stream across. The stream is three times as large fifty miles higher up at the Cooktown and Palmerville Road.

Observations of Vega and Arided made the latitude of this camp 14 degrees 53 minutes 9 seconds. [Camp 31; Kennedy River; Moreton Bay ash, J.; 3/9/1879.]

September 4.—Left Camp 31, the track still keeping north-west (magnetic). A quarter of a mile from the Kennedy we crossed an anabranch or tributary nearly as large as the river itself, but driep up to waterholes. Its junction with the river was visible from the track.

Two miles from the Kennedy we crossed the bed of a large river, with several channels, running north-north-west, but dried up to waterholes. This stream has a rocky bottom (recent "cement-conglomerate"). It has no banks to speak of, its bed being only three or four feet below the level of the surrounding country. I fancy this must be the river named the "Hann" by Mulligan.

In three and a-half miles further we crossed a large deep sandy river bed, dried up to waterholes, with a few palms (*Seaforthia*) on its banks.

In three and a-half miles more we crossed another deep sandy river bed (not so large as the last), also dried up to waterholes. A few palms and Leichhardt trees graced its banks.

In four and a quarter miles further we crossed a large bare creek, with a bottom of recent sandstone or cement, with large waterholes, cemented by a narrow stream running north-east. In another mile an isolated mountain (the first landmark seen for some days) bore north 39 degrees east. It seemed about fifteen miles distant.

Two miles further on we entered on a wide open plain, crab-holed in places. It must be a swamp in wet weather. It appears to extend north-east and south-west for at least ten miles. On our course we crossed it in five miles, and found Saltwater Creek at its further boundary. We camped on a chain of lagoons on the right bank. The water was very muddy, having been recently disturbed by the digging of lily-roots. [Camp 32, Saltwater Creek.]

The natives were burning the grass all over the open plains. We saw three gins at the waterholes, but they ran away. The boys started a blackfellow from his lair in the long grass by the lagoon near our camp; he ran away, leaving behind him a spear and fishing net. The spear was destroyed by the boys.

The country passed over on this day's march was poorer than that of the preceding day, the soil being more sandy; still it was fair second-class pastoral land. The timber was for the most part bloodwood, with a few box and ironbark trees: on the low ground pandanus, cabbage-tree and tea-tree.

From the camp the mountain observed in the early part of the day subtended an angle of 2 degrees from east 26 degrees north to east 24 degrees north (true). It has apparently a capping of sandstone. Its position must be near the bottom of Princess Charlotte's Bay—probably between the mouths of Saltwater Creek and the Kennedy.

The kangaroo dog killed a bandicoot—its sole achievement on the journey.

We kept a watch all night, as we knew that natives were camped near us.

September 5.—In the morning, as we were packing up, two blacks reconnoitred us from a distance of about a furlong. Having satisfied their curiosity, they lighted a fire and made themselves comfortable.

Grainer had on his previous trip turned back at Saltwater Creek, having met there with troops of diggers returning from the Coen with discouraging reports. We were therefore without any information as to the remainder of our journey.

Saltwater Creek, when we crossed it, was running a strong current of salt water, the tide being near its ebb. The tide rises about four feet at the crossing. The track runs the right bank up for about a mile. It cost us three hours' time to pick up the track on the left bank, which is flanked by a double and sometimes treble chain of deep lagoons. North of the creek the track bore west 36 degrees north (true) through a very gently rising country, with a light sandy soil supporting a well-grown forest of bloodwood and stringybark and a few ironbarks. In three miles we passed a swamp on the left.

From this point the track bore north 44 degrees west (true), through similar country. In three miles we crossed a sandy watercourse of the third magnitude.

After seven miles more of poor, flat, sandy country, mostly timbered with tea-trees and bloodwood, with a few pandanus and cabbage-trees, we came to a fourth-magnitude creek. On running it up for half-a-mile we found a waterhole, containing about enough for ourselves and the horses for one night. We camped on the left bank. Beside the creek we found some old camps, and a tree marked "*James Gillige.*" [Camp 33; Moreton Bay ash; J. 5/9/79. Latitude 14 degrees 34 minutes 17 seconds.]

September 6.—We made a late start, the horses having split up in the night owing to the poor quality of the grass; half of them were found at a large creek, with plenty of water, to the north-east. There was also plenty of water higher up the creek on which we were camped. In a quarter of a mile (to magnetic north-west) we crossed from the right to the left bank of a third-magnitude creek with waterholes and old camps beside them. The creek on which we camped last night must fall into this one. In half-a-mile more we crossed from the right to the left bank of another third-magnitude creek, with water in a muddy hole.

Five

Five miles from the camp we came to a fourth-magnitude creek, with cabbage-trees, plenty of water, and traces of camping. Up to this point we had crossed poor, flat country, with tea-tree and bloodwood. Here it is evident from the soil that granite begins to replace the "sandstone-cement."

In two miles, after crossing a large open plain (with a bush fire raging on our right) we entered belt of enormously tall and close stringybark and bloodwood forest land. The ants had crusted more than half the trees, up to twenty or thirty feet from the ground, with a red mortar. This and the subdued light which penetrated the dense and lofty foliage gave a strange sort of sunset effect even at mid-day. The trees are so closely grown together that it must be very difficult to manœuvre a dray among them. The forest occupies the crown of a very gentle rise. The soil is reddish, and apparently derived from the decomposition of a ferruginous schist. The forest was two miles across.

Another gentle rise, a mile across, is covered with open forest of bloodwood and stringy-bark. At its north-west side we crossed from the right to the left bank of a large third-magnitude creek with a deep sandy bed (granitic sand).

A quarter of a mile further on we came to a large second-magnitude creek. It had a broad sandy bed, partly choked up with tea-trees. We ran the creek up for about half-a-mile (west) and crossed to the left bank.

After a mile and a-half on a course of west 26 degrees north (true) through poor country (tea-tree and quinine-tree bush), we caught sight of some mountains—the first we had seen for some days. They subtended an angle of 72 degrees (from west 36 degrees south to west 36 degrees north, true). A mile and a-half over gently undulating poor land timbered with bloodwood and stringybark took us to a chain of waterholes, on whose right bank we camped. [Camp 34; gum marked J./6/9/79.

A pheasant, bandicoot, and iguana made up to-day's game list.

This seems to have been a favourite camping-place. We found trees marked "July 10, 1878;" "R. S., 1878;" and "July 21, 1878, G.H." Latitude 14 degrees 23 minutes 22 seconds.

September 7.—On leaving Camp 34 we followed the track, which bore away west 36 degrees north (true) for one mile and west $28\frac{1}{2}$ degrees north (true) for two miles, through open bloodwood and stringy-bark forest, when we crossed in two miles a fourth-magnitude creek flowing freely (over bars of recent gritty "cement"), with remains of old camps. Mountains were now visible to the south.

In one mile more, on the same course, a gentle ascent began, and the "bed-rock" became visible for the first time since we left the sandstone ranges east of the Normanby—a very peculiar reddish granite, with tin-white mica and very little felspar. A change in the timber commenced with the change in the soil, small ironbarks being mixed with the usual stringybark and bloodwood trees.

In two miles further (to the north-west) the track led up to the summit of a granite ridge, covered with well-grown bloodwood, stringybark, and ironbark timber, about 200 feet above the level of the plain.

In one mile to the north-west, over very easy ridges, we crossed from right to left bank of a fourth-magnitude creek with considerable waterholes. We found trees on the left bank marked "W. R.," "C. J.," and "C. N."

In two miles more on the same course, with a gradual sinuous ascent, the track reached a saddle in the range about 600 feet above the level of the plains which we left in the morning. The rock was a granite, of loosely aggregated quartz granules, tin-white mica, and very little felspar, with outcrops of gneiss here and there. On the saddle was a tree marked "M. F." On this range the bloodwood trees attain an enormous size; the stringybarks do not enlarge with the increased altitude; the ironbarks are large, though not numerous.

The track led for half-a-mile from the saddle north-westward down the right bank of a gully which it then crossed, and for a mile and three-quarters, with a very easy descent, to the right bank of a gully falling to the north. Having run this down a quarter of a mile, the track crossed to the left bank and continued to the north-east for one mile—the greater part of the way along the right bank of a deep fourth-magnitude creek with waterholes and the remains of a camp.

About half-a-mile more to the north-west over an easy ridge, with lofty bloodwood and stringy-bark timber, we crossed a fine creek of the second magnitude, with Leichhardt and tea trees in its sandy bed. This creek has two channels, but neither yielded a drop of water, though we searched for about a mile up and down. There can be little doubt that this is what Hann named "Balclutha Creek" when he crossed it nearer the sea.

In two miles more to north 39 degrees west (true), mostly descending through open bloodwood and stringybark country, we came to a watercourse with deep waterholes and lilies, and the remains of an old camp. We crossed it and pitched our tents on the left bank. [Camp 35; Moreton Bay ash marked broad-arrow, J./7/9/79. Latitude 14 degrees 16 minutes 12 seconds S.]

Three bandicoots and a pheasant furnished a sumptuous dinner.

September 8.—The track, continuing to north 39 degrees west (true), took us in two and a-half miles over level country with a bottom of recent "cement" to a third-magnitude creek running north-north-east; in two miles more, to a fourth-magnitude creek with water in "cement;" in one mile further, to a second or third-magnitude creek (dry) with "cement" bars falling to north-north-east; and in one mile and a-quarter further, to a granite knob about 300 feet high, which I ascended (naming it "View Hill)." A very extensive series of bearings was obtained from this eminence, and utilized in the construction of the map accompanying this report.

In half-a-mile we crossed a creek of the third magnitude with a sandy bottom—the forks and ridgepoles of several tents still standing.

The track here altered its course to north $16\frac{1}{2}$ degrees west (true). In two miles it crossed a sandy third-magnitude creek with water.

In one mile and a half on the same course we came to a large first-magnitude creek or river, not less than sixty yards wide, with a goodly stream of water running to the east. It has several channels, with large Leichardt-trees on banks and islands. The bottom is granite. One horse laden with flour sunk in a quicksand, and had to be unpacked in a hurry and helped out. This is the river which Hann named the Stewart. It was the northern limit of his journey.

All the creeks crossed on this day's march, except the one we left in the morning, fall into the Stewart.

One

One mile to magnetic north brought us by a very gentle slope to the summit of a granite ridge, about 150 feet above the river. Another mile north 16½ degrees west (true) took us across a valley, about a mile from its head, which drains to west-south-west into the Stewart, and up to the summit of the ridge forming the right wall of the valley. From this point (about 500 feet above the Stewart) another series of bearings was obtained.

The granite of this ridge is very coarse-grained, with large flakes and crystals of tin-white mica and crystals of orthoclase felspar, sometimes two inches in length. The felspar crystals are almost always flecked with mica. A good deal of white vitreous-looking quartz is scattered about.

Half-mile north took us, by easy zig-zags, across the head of another valley to the crown of another ridge, about 200 feet higher. In half-a-mile to north 39 degrees west, we came to a gully with two waterholes, falling to the south-west. As there was fine burned feed here for the horses, we camped here on the right bank of the gully. We prospected up the gully, and got much black sand but no gold. [Camp 36; box, broad-arrow, J, 8/9/79. Latitude, 14 degrees 5 minutes 20 seconds.]

September 9.—The track continued to north 39 degrees west, and brought us in half-a-mile to the crown of a table-land of granite with "blows," quartz. The timber is ironbark, bloodwood, and small white gum. The track next led due north for a mile over similar country, with similar timber, when an outcrop of mica schist was seen, striking north-north-west.

In a quarter of a mile more, magnetic north-west, View Hill, and many of the peaks recognizable from that eminence were sighted and their bearings taken.

In half-a-mile on the same course we crossed a creek of the second or third magnitude, with a granite bottom, and a fair stream of water flowing to the south. The left bank bore numerous traces of camping, and, besides, the following inscriptions:—

M. FOX. July 21, '78,	NOTICE TAKE WRIGHT COE,	and W. STEWART.

The trees were defaced with indecent drawings rudely cut out with tomahawks—a sure sign that the artists were getting nothing, and waiting idly for news from the parties at work at the Coen. I call this creek Notice Creek, as some of the diggers may recognize it from the gigantic inscriptions above quoted. It is one of the heads of the Stewart River.

We next followed the track west 28½ degrees north (true) for one mile up easy slopes drawing into Notice Creek, and for half-a-mile down (through granite country) to a second-magnitude creek, with a good body of water flowing slowly to the south-west. A large "blow" of white quartz runs east and west on the right bank. Three conical peaks occur down the right bank, within a mile of the track, while the left wall of the valley is formed of rounded granite mountains. This creek also is, in all probability, a head of the Stewart River.

The next three miles, on a course of north 39 degrees west (true), were chiefly on the north-east side of a porphyry ridge, and brought us to a third-magnitude creek flowing from the east. In a mile and a half more, in the same direction, across sharp ridges, with sugar-loaf cones to right and left, we crossed to the right bank of a third-magnitude creek running in a very confined valley to the south-west. We followed the right bank down for a quarter of a mile, and found a temporary yard, some horse tracks (newer than the spring rains), and a railed grave. It would be impossible to say, without following them down, whether this and the creek last passed fall into the Stewart, or feed the Coen or the Lukin, and drain into the Gulf of Carpentaria.

We then followed the track in a general direction of west 28½ degrees north (true) for four miles through very broken stony country, with a line of conical peaks on our left. The peaks were twelve in number, and we named them the "Twelve Apostles." Next, having followed a gully down for a mile to its junction with a creek of the third magnitude, we crossed from the left to the right bank of the latter and travelled for a mile due north, across a patch of well-grassed, open country, nearly level—a fine site for a township or small station.

The path now led us across a third-magnitude creek (Shanty Creek), with a killing-yard, and the ruinous remains of a shanty on its further or right bank, near its junction with the Coen River. We camped here between the river and the creek. [Camp 37.] Latitude of the Coen River mining camp 13 degrees 53 minutes 42 seconds (determined by observations of Vega and Arided).

As we approached the site of the old diggings, signal fires broke out on the Twelve Apostles, in advance of us, in such a manner as to leave no doubt on our minds that the aboriginals (themselves unseen) were honouring our progress with their serious attention. Their object could not have been to molest us by burning the grass, as the valleys had been burned two or three weeks previously, and afforded abundance of sweet grass, too green to burn.

Brusher shot a small kangaroo, which furnished us with fresh meat for two days.

In 1876, a party of fifteen went out to prospect the peninsula. They split up about the Coen into three parties. The party who remained here (Messrs. Sefton, Verge, Watson, and Goodenough) got on gold about September, 1876. They returned to Cooktown in December of the same year, with sixty ounces of gold among them. They returned to the same ground in May, 1877, and stayed till December, when they came back to Cooktown with 140 ounces. The prospectors, in consideration of £200, subscribed in Cooktown, marked out the track in February, 1878, and were followed by a crowd of diggers. The diggings continued till about July, 1878, when they were abandoned.

The prospectors, and the diggers who followed them to the rush, believed that they were on the Coen River, which enters the Gulf of Carpentaria in 12° 13′ S. lat.; but, as already mentioned, the camp is in 13° 53′ 42″ S. As I then and afterwards followed the river down for nearly twenty miles to the west, and found several large rivers between it and the latitude of the Coen, I have no doubt that the river, instead of the Coen, is Kendall Creek, crossed by the Messrs. Jardine, in 14 degrees S. latitude, on their famous journey to Cape York, in 1864-5.

The aspect of the site of the rush differed but little at the date of our visit from that of other abandoned diggings. The first thing to strike the eye of one who had travelled more than 250 miles from the nearest civilised dwelling was, of course, the building which had done duty as public-house and store—a rough frame of saplings, with walls and roof of messmate bark, and with a bar fashioned out of

barrel staves and the timbers of brandy and gin cases, opening on the verandah. Hundreds of bottles, mammoth heaps of bones, and scores of jam, butter, and sardine-tins attested that, for a time at least, good living was the order of the day. A hundred yards off, across a gully, stood the killing-yard, still in good repair. Two miles up the river is the prospectors' hut, strongly built of squared logs, loop-holed and spear-proof—the strong tower in which the four stout hearts held their own against all the native population of the peninsula. Here and there a bough-shed, a few groups of charred tent-pegs or ridge-poles, and occasionally the frame of a "bank,"—were all that remained of the less ambitious dwellings at the time of our visit.

The last to abandon the place had buried in the cellar of the shanty about half-a-ton of flour, with drapery, crockery, groceries, tools, and cooking utensils, partly with the view of not letting them fall into the hands of the blacks and partly in the hope of the stores being useful if the place should still turn out well. We found the whole untouched, but hopelessly damaged by water, the rain from the roof having found its way in the wet season through the funnels (hollow trees) provided for ventilation. The very "high" smell of the decaying flour led us for a time to believe in the proximity of an extensive deposit of fine old cheese. As we were the last who could possibly benefit by it, we saved all the flour that we could (about 14 lbs.) by drying it in the sun and parching it in the frying-pan. Thus cured, it was baked into dampers for the dogs and, as far as it went, saved our little store.

Considering what prizes the tomahawks, saws, shovels, and other iron tools would have been for the blacks, we were not a little surprised that the cellar had not been rifled. As a rule, the natives fashion, with infinite pains, such unconsidered trifles of old iron as shovels, broken pick-heads, scraps of iron-hoops, ship's bolts, telegraph wire, nails, cart-wheel tires, and the like into weapons and implements with which they perform prodigies in the way of tree-felling. In the present instance, besides the buried iron implements, there were many pick-heads, shovels, &c., lying loose on the ground near the different camps.

September 10.—Spent the day in plotting the route and making skeleton maps for use during the remainder of the trip, utilizing the "bar" as a drawing-table. Macdonald and Granier were set to work washing the sand in the river bed. They got small specks of gold in every dish, but not enough to pay for a white man's food.

September 11.—About two miles north of the shanty the river tumbles merrily out of a gorge forming a series of cascades over thick nearly vertical beds of greywacke, whose strike is from north to south. The greywacke beds form the crown of the hills on both banks of the river, as well as the most constricted parts of the gorge. In other parts of the river bed, as well as on the hills, nothing but granite is seen. The granite has large roundish grains of quartz, orthoclase felspar in crystals up to two inches in length, and tin-white mica sometimes occurring in large plates. We prospected above the gorge, but got no gold.

Above the gorge the river comes from the east for about half-a-mile The upper part of its course is from north to south, or a little to the east of north. For two miles above the gorge it is flanked by pretty high hills on the right bank with comparatively low rolling granite hills on the right bank. We prospected two miles above the gorge, and got much magnetic iron sand, with fine "colours" of gold. About three miles higher the valley gets very narrow, with granite "tors" on the right bank.

Below the gorge a low gap divides the waters of the "Coen" (or Kendall) from a valley falling northward into the Peach River. We got "colours" in the bed of the Kendall (?) below the gorge. On an alluvial flat, on the right bank of the river, here was the Two-mile Camp. Near this camp, a third-magnitude creek with large waterholes falls into the river. A large white quartz reef crosses it twice in an east and west direction. Above the lower crossing of the reef, a patch of alluvium on the left bank has been diligently tested in numerous shafts. In one of these we got fair colours, as well as in the creek itself. A ravine known as the Two-mile Gully falls into the right bank of the creek, and the wash has been worked out. It was from this ravine that the prospectors got the bulk of their gold. Their fortified hut, already referred to, stands on the right bank of the creek between the ravine and the river.

I ascended the hills behind the hut, and found them composed of foliated brownish mica schist and quartzite. From the top I could see to the N.N.W. down the valley above referred to as draining into the Peach River, to a high conical mountain (Mount Croll), apparently about ten miles off.

A well-beaten horse-track was found to lead from the fortified camp, through a low gap to west 16½ degrees south (true). Half-a-mile from the camp it crosses a quartz reef 6 or 8 feet wide, running west 30 degrees north, and traceable for 100 yards with iron-stained cavities, and interlacing dog-tooth crystals of quartz along lines of joint. A good deal of picking had been done on this reef, and specimens showing gold obtained. The "surface" and alluvium of a small gully draining the reef had also been worked. We obtained colours in the surface, and from some of the quartz which we broke up we obtained small "colours," and a little cloud of almost impalpable gold dust.

A quarter of a-mile further a dyke (N.N.W. to S.S.E.) of compact silicated felstone, four feet in width, crosses the track. A mile beyond this the track divided and died out.

September 12.—Prospected up the river with the results related (for the sake of connection) under date 11th September.

September 13.—We followed a track up the right bank of Shanty Creek (east-north-east). For the first mile we had gently rolling country. Then the track ascended by two steep pinches (granite) to the top of the tableland, after which it went parallel with the creek (north-east).

Four miles up the creek from its mouth we crossed a large reef, with red iron oxide strings and leaders in it. This reef was traceable for some distance to north and south.

Half-a-mile higher (after the track has crossed to the left bank of the creek a reef, four feet in width, occurs on the left side of the track). It runs north and south, and has a distinct hanging wall on the east side. It contains very good-looking stone, red and yellow in joints, with crystalline cavities, the faces of the small crystals stained red with iron oxide.

Half-a-mile higher the remains of a camp, extending for half-a-mile on the right bank of the stream. One dam stands entire. A great deal of work had been done, chiefly in the bed of the creek. There is a good deal of quartz in the stream, but, to judge by our own success in prospecting, the workings must have been far from remunerative. The bed of the creek here is divided by bars of granite into long deep reaches. Long races and flood-races, and numerous toms, cradles, &c., attest the activity of the work.

Nearer

Nearer the mouth of the same creek, about a mile and a-half above the shanty, a long bar of granite runs diagonally across the creek, and here the bed of the stream has been sluiced, with small success.

On the crown of the hill between the river and Shanty Creek we found a reef running north and south. It is rather a double coating of quartz crystals on the opposite faces of a long joint in the granite. The quartz crystals are dyed blood-red, and I have no doubt that at a greater depth the interspaces are filled with bloodstone and pyrites.

Taking into consideration the long land carriage from Cooktown, which must add about a shilling per lb. to the price of all the necessaries of life (except meat), the poor quality of the gold (which had a very large proportion of silver, and in some cases was actually worth no more than 30s. per ounce), and lastly, the limited quantity obtainable, I came to the conclusion that the alluvial diggings of the so-called "Coen" would not employ white men at a remunerative rate. They might, however, pay Chinese labour.* The quartz reefs, however, might pay to work if machinery were on the spot.

September 14.—Having taken stock of our flour, I determined to push out to the north for two or three days. Leaving our camp (No. 37) we passed the "Two-mile Camp," and steered north 16½ degrees west (true). In two and a-half miles we were clear of the valley of the Coen (or Kendall), our travelling being all through good second-class pastoral country. The same hollow between the main range and the isolated mountain mass to the west continued for two miles further, when a long deep valley opened into it from the main range. The creek (Croll Creek) which forms this valley, after emerging from the mountains, falls to the north-north-west. In two miles from the mouth of the lateral valley, the hills on the west die out. I ascended a little hill (white compact quartzite), and saw clear open country for about twenty miles from north-north-west to west-north-west, when a not very high range subtended the greater part of that angle.

After two miles of travelling along the left bank of the creek, we were abreast of the conspicuous pinnacle seen from the hill behind the fortified camp. I named it Mount Croll, after my former colleague, Dr. James Croll, the distinguished author of "Climate and Time."

At Mount Croll we crossed the creek. It was here of the second magnitude, with a deep broad sandy bottom, divided into two channels It had, however, but little water.

In a mile and a-half to the north we touched a headland of the main range (granite). We packed some wash-dirt from behind a granite bar in a little dry gully to the next water, but on washing it we got no gold. I ascended the point and took bearings. The range appears to trend north-north-east. A headland about twelve miles off lay north 18 degrees east. A range about the same distance subtended an angle of from north 12 degrees east to north 10 degrees west.

We struck north 18 degrees east by the track. In one mile we crossed a little dry gully with pegs of two tents standing. This was probably one of Sefton's camps, when he penetrated to the North during his second stay at the "Coen." The track continued for a mile further to the north-east, when it was no longer recognizable.

We continued on a course of north 18 degrees east. In half-a mile we entered, and in one mile more got through a scrubby thicket of grass-trees (*Zanthoria*), bloodwood, and tea-trees, quite bare of grass. One mile more on the same course brought us to a sandy creek of the third magnitude, with plenty of water, and—which was of more importance after the alarming desert country we had just left—green-burnt feed along the left bank. This watercourse I named "Horne Creek." We camped on the left bank. [Camp 38; Bloodwood, broad-arrow over J/14/9/79.] Mount Croll bears south 13 degrees west from this camp.

The first part of the day's journey, that within the "valley" proper, was very tolerable country, with good grass (recently burnt for the most part). The trees were mostly bloodwood and box, with a few ironbarks and stringybarks.

The greater part of the day we followed a well-marked horse track (deeply impressed, as if in rainy weather). In places we lost it, and in one place we abandoned it as it went too much east, but we were distinctly on it at the old camp (see map). At our camp on Horne Creek we found tracks of horses feeding, and signs of prospecting in the bed of the stream. The creek at our camp had a fair stream of running water two yards wide. We prospected the creek, but got no gold, although there was much magnetic iron-sand in every dish The latitude of Camp 38 I found to be 13 degrees 45 minutes 47 seconds.

September 15.—On leaving Camp 38 we had hard work to get away from the Horne; first in getting the horses down the steep sandy bluff on the left bank, then, in getting them up the high cliffs of "cement" on the right bank, and lastly in clearing a deep gully cutting through the cement. The Horne has large tea-trees in its bed, but no scrub.

Three miles from the Horne, through grass-tree, bloodwood timber, and scrub, we came to a large river which I named the "Peach," after my former colleague, Mr. Benjamin N. Peach, of the Geological Survey of Scotland. The Peach here has a large body of water—a stream of five yards wide and one foot deep, running at the rate of two miles an hour to west-north-west. The river strongly resembles the Morgan, near Cooktown, in its general features, with tall dark-leaved trees, lofty palms, and gigantic figtrees with their beautiful fluted roots, nutmeg-trees, laurier vines, and canes.

The bed of the river was gravelly on top, with a fine gritty sand below, to which we could find no bottom. Anywhere in the fine sand we could get numerous but fine specks of gold in every dish. I regretted exceedingly that time would not permit of prospecting this river thoroughly, as I surmised that payable gold might be found in places where it was possible to bottom.

We ran the river up for a quarter of a mile, and found rapids running over granite bars. The granite had small granules of quartz, small orthoclase felspar crystals, and tin-white mica, and hornblende. Among the bars we got a little ruby tin, but no gold.

We followed up the right bank of the river for two miles east-north-east through desert country—grass-tree, quinine-tree, tea-tree, and spinifex grass (the latter recently burnt). At the end of the two miles we came on pretty country, with bloodwood, Moreton Bay ash, and oaten-grass. On the left bank some low granite hills came down to the river. In a mile and a half through country of this description we crossed a deep sandy tributary falling into the right bank, and continued our course up the river.

* Since the above was written (in 1880), a large number of Chinese tried the ground, but were unable to make a living

After two miles more across gullies and ridges (the grass still smoking, and bush fires ahead of us, up the valley) we tried the river again, although we could get no bottom. We found much black sand, but no gold. The river here has a magnificent fringe of scrub and palms.

We then retraced our steps for three and a-half miles, and camped in the good country on the right bank of the river. [Camp 39. Latitude 13 degrees 39 minutes 7 seconds. Trees marked "broad-arrow, J 16/9/79;" and "Peach R."]

We obtained fine colours of gold here below granite bars in the river.

After we had camped I crossed the river and ascended the low granite hills on the left bank. I found a wide north-and-south reef on the top, underlying to the west at 45 degrees. This reef is seamed with longitudinal veins of brownstone. On crushing and washing some of this stuff we obtained a little very fine gold dust.

September 16.—Leaving the Peach River we struck north-west, and in five miles crossed a large, deep, dry sandy creek, between high "cement" walls, on a granite bottom, falling south-west. We prospected the creek but got no gold. In three miles further we came to a deep dry creek of the third magnitude. In half-a-mile to the north-west this creek falls into a creek of the second magnitude, with a thin stream of water in a sandy bed coming from the east. I named this Irvine Creek. In two miles more, up a gradual slope to the north-west, we reached a blunt conical hill of granite, about 500 feet above its base, which I ascended. This was our northmost point, and I named it Birthday Mount, as I reached it on my birthday. From this point I took a series of bearings. A range dimly descried to the westward I named the Geikie Range, after the Director of the Geological Survey of Scotland. The Peach River could be seen to the south-west, making its way through a gap in this range.

The whole of the country traversed on this day's journey was very poor, with scanty spinifex grass (recently burnt), and grass-tree and tea-tree. The natives were busy burning the country between the Geikie Range and Birthday Mount.

Having now penetrated as far to the north as was prudent, considering the quantity of rations now remaining, we turned our faces homeward with the intention of striking the Palmerville and Cooktown road, about the bend of the Kennedy. In two miles south 2 degrees west, through tea-tree and grass-tree country, we reached Irvine Creek, and camped on its right bank, where the horses had good feed among lagoons. We prospected the creek at the camp, but found no gold. [Camp 40. Trees marked broad-arrow, J 16/9/79; and IRVINE CK.]

September 17.—We found it rather difficult to get away from Irvine Creek, which had high sandy banks fringed with scrub and a chain of lagoons on both sides. In two and a-half miles south 2 degrees west from the creek we came on tracks of thirteen horses which had come and gone north and south in wet weather. In another mile we came to the Peach River, here flowing to the north-west. We prospected here but found no gold; but there remained in the bottom of each dish about two ounces of a very fine grey sand, which, on being examined afterwards, turned out to be amber-coloured tin ore in microscopic grains. Some very large Leichhardt-trees were seen in the scrub here.

In two miles more on the same course we reached Croll Creek, running nearly north with a wide shallow, bare bottom, partly of sand and partly of cement. After crossing it we kept for half-a-mile on the same course within sight of its left bank.

Eight miles further we entered a well-grown forest of stringybark, bloodwood, and ironbark trees on red soil, rising gently to the range on the left. As we did not cross Horne Creek it must have fallen into the Peach, between our upper and lower crossing of that river.

In two and a-half miles more we crossed a low watershed and continued on our course by gullies falling to the south, with low stony ridges on which the grass had just been burned. Bush fires were raging within half-a-mile of our route. It was now near sunset and our march became a hurried scramble to get water before nightfall. In three and a-half miles from the watershed, the hills receding to our left to form the north wall of the valley west of the Two-mile Diggings, we were fortunate enough to find beautiful green feed and three little waterholes in a gully running south. Here we camped. When night fell we could hear the sound of running water, and it turned out that we were only half-a-mile from the Coen (or Kendall). [Camp 41. Bloodwood, broad-arrow, J 17/9/79. Latitude 13 degrees 53 minutes 48 seconds.]

On this day's march, as far as Croll Creek the country was a desert, of the same description as that passed through yesterday. It slightly improved southward and became more open, with a few bloodwood and stunted ironbark-trees. South of Croll Creek, for about two miles, there were several unwooded plains with tolerable grass, but with innumerable little anthills among the roots of the grass. Then there is a relapse into grass-tree and spinifex desert—hardly so poor as yesterday's, however—to the beginning of the forest. After the ridgy country on the south side of the divide between the Peach and Kendall (?) waters was passed, we had about a mile of fair open bloodwood country.

On the ridges south of the divide there are some outcrops of ferruginous schist, and a good deal of quartz, with one promising reef.

September 18.—In the morning, while the horses were being rounded up and packed, I went back to the reefs on the ridges. They run generally north and south and are well defined, but have not much appearance of iron oxide, which is usually characteristic of auriferous reefs. The low rolling country at the base of the hills is of ferruginous mica-schist. The mountains are granite. I heard a party of natives chanting among the rocks.

On leaving Camp 41 we steered south 6 degrees west (true), and in half-a-mile came to the Kendall (?). The river here has a bottom of fine-grained decomposed granite. On prospecting we got fine colours of gold, much black sand, and many small garnets. On the left bank of the river was a large white quartz reef, with red joints and cavities filled with brownstone.

From the Kendall (?) we struck south 15 degrees west (true). In the first mile we passed three large white quartz reefs, striking north-west and south-east. Three miles from the river over rolling stony country, with ironbark, stringybark, and a few bloodwood trees, we touched some low hills of ferruginous mica-schist on the left, almost detached from the main range. I ascended one of the hills and had a look ahead.

We

We now shaped our course to the south. The first two miles led us over low ridges (spurs of the hills on the left) of ferruginous mica-schist, with numerous quartz reefs. The next three miles were of more rolling, white granite country, with a good many reefs. For two miles more we traversed gneiss country. From the hill which I ascended there were no creeks of any importance, but only dry gullies falling to south-south-west. The timber was tea-tree, bloodwood, and ironbark. The grass was of middling quality, but it had mostly been burnt a day or two before.

The next four miles were of soft granite debris in gently-rolling downs, undermined by ants; the grass poor; the timber bloodwood and box. The mountains on the left recede almost out of sight.

For one mile we steered south-east (to avoid a low range to the right) over stony ridges covered with angular quartz fragments.

In one mile further to the south—just when the march had again become a race for water—we found a rather boggy swamp with good grass, and camped. [Camp 42; bloodwood, broad-arrow, J 18/9/79. Latitude 14 degrees 5 minutes 18 seconds S.]

Near our camp we passed a recently-abandoned cluster of gunyahs, twelve or fifteen in number, each capable of accommodating two men. They were made of long sheets of bark placed edge to edge over two ridge-poles supported on forks—an idea which the natives probably borrowed from the diggers.

September 19.—On taking stock of our flour in the morning, I was glad to be able to increase slightly our daily allowance, in the belief that no great physical difficulties lay between us and civilisation.

On leaving Camp 42 we steered south-south-east. Within a mile of the camp we surprised a party of natives—first, a gin with a child. The gin ran off with a piercing howl. Another gin and a man made off in a different direction. Then a man with a gin and child. The man in running away left his spear behind. Lastly, two men, who, like the rest, were too shy to be approached. The party appeared to be travelling in groups of two and three.

Three miles from the camp we crossed a third-magnitude creek running south, with waterholes in a sandy bed. In one mile more a third-magnitude creek was passed, running west, with a waterhole beside a granite bluff. In one mile and a-half more we passed between two swamps. Five miles further we crossed a fourth-magnitude creek with a chain of deep waterholes. One mile further a similar creek with a waterhole. In one mile more another fourth-magnitude creek with deep and wide lily waterholes.

In half-a-mile more we crossed the Lukin River of Mulligan, rather a creek of the first magnitude than a river as yet. The creek had many dry channels. Its bed was graced with Leichhardt-trees and tea-tree, but no scrub. It had scarcely any water, only a few shallow holes in one of the channels. We prospected a little in the bed of the river, but got no gold.

A mile and a-half from the Lukin we crossed a fourth-magnitude creek (a byewash of the river), with water. In two miles more, across country burnt only a few hours before, we came to a little gully with water in holes in the "cement" bottom, and green picking for the horses on its banks, and camped. [Camp 43; bloodwood, broad-arrow J 19-9-79. Latitude, 14 degrees 21 minutes 11 seconds.]

The blacks had neglected to burn the country passed over to-day, north of the Lukin, but it was poor in the extreme, the grass being mainly spinifex, and but little of that. The timber was for the most part tea-tree, bloodwood, and ironbark. The country was gently undulating, the subsoil being composed for the most part of a granitic "cement." The timber rather improved southward, but the grass did not.

September 20.—Almost immediately after leaving Camp 43, we began to mount a low range. At the distance of two miles from the camp we crossed a third-magnitude creek with a broad, dry, sandy bed, falling to the south. Another mile took us up to the crown of the range, which is about 400 feet above the level of the plains. The range is of granite, with some unaltered greywacke. There is much quartz scattered about, with a white and "hungry" look. Large flexible crystals of biotite are imbedded in the quartz.

About fifteen miles to the north-west I could see a high range, apparently capped with horizontal sandstone.

For one mile further our course lay to the left of, but within a few yards of, the crown of the range. This low range is composed of very coarse granite with enormous felspar crystals, and crystals of quartz up to 1 cubic inch. The ironbarks on the ridges are large and strong. There are a few stringy-barks and stunted white gums, but no bloodwood-trees. We packed some washdirt to the nearest water from a dry gully running east, and on washing it obtained some colours of gold.

In half-a-mile more we were on the top of the range. The gullies behind flow to the east at first, and then swing round to the north and north-west. Before us was a table-land sloping gently to south-south-east.

Five miles further (after having passed two gullies with waterholes) falling to the south we came to a third-magnitude creek running to the south-east.

In three and a-half miles more we crossed a large river (the King River of Mulligan) falling to the south-west. It has a dry, sandy bed, divided into four or five channels, with only a few shallow waterholes. There are several anabranches or "byewashes" on both sides.

On the south side of the King River we found the country much broken up into ridges, with gullies. Two and a-half miles from the King we crossed a second-magnitude creek, running parallel with the river, with a dry, sandy bed.

In two miles more we arrived, just before sunset, at a small waterhole in a gully running west, and camped. Unhappily the grass had just been burnt, but we drove the horses back for about half-a-mile to some rather scanty burnt feed. [Camp 44; white gum, broad-arrow, J, 20/9/79.]

The whole of this day's travelling was very interesting, with the exception of the low range between the Lukin and the King, as it presented only a succession of low ridges and unnameable and unmapable gullies. The soil, if it could be called soil, was of decomposed granitic cement, into which the horses sank two or three inches at every step. The grass was poor, the timber was mostly stringybark and ironbark, with a few bloodwoods; tea-trees in the wet bottoms.

September

September 21.—We travelled seventeen and a-half miles south-south-east over country very like that of yesterday, but on the whole rather more rolling and with fewer ridges. We camped on a little gully trickling to the east, with a patch of burnt feed on its left bank. Except this we did not see a single mapable watercourse the whole day. Five miles back from the camp we saw some cattle tracks, and two miles from the camp the tracks of two horses going north. [Camp 45; stringybark, broad-arrow, J, 21/9/79; latitude 14 degrees 48 minutes 45 seconds S.]

September 22.—We steered south-east from Camp 45, at first over rolling granite country. In one mile we passed a patch of mica-schist striking north-east and dipping to the south-east at a high angle. There were seen here some promising reefs striking north and south, with a good deal of brown-stone (decomposed pyrites) in cavities. Two miles from the camp we crossed a dyke, two or three hundred yards wide, of dolerite, running north and south through the schist and forming a low hill. The improvement of the grass on the dolerite soil was sudden and striking. A large white reef of quartz runs through the schist on the eastern side of the dyke. From the summit of the dyke I could see Hann's Mount Garnet, to the south-south-west.

Three and a-half miles from Camp 45 we passed some fine waterholes in a fourth-magnitude creek running south-west over a bottom of grey granite.

Five miles from the camp we crossed the Coleman River of Hann, here running from north-east to south-west, with a dry, sandy bed, divided into four or five channels. On the left bank was an out-crop of ferruginous mica-schist and much loose quartz.

A mile beyond the Coleman, on the right bank of a third-magnitude creek, running south-west with plenty of water, we saw a recent native encampment of very superior workmanship, with accommodation for about twenty men. The dwellings were practically tents. Two forks sunk in the ground approach each other at the upper ends, like a truncated A, and carry two ridge-poles, over which the roof—sheets of bark—is bent. Between the forks two parallel logs support sapling joists, on which sheets of bark are laid for sleeping-bunks.

Seven miles from the camp we passed some enormous and fantastic blocks of grey granite, and saw a flock of very little birds, apparently no larger than butterflies. I could not, however, shoot any. My impression is that no bird so small is known in Australia.

In one mile more we crossed first from right to left, and then from left to right bank of a fourth-magnitude creek with large waterholes.

In two miles more we got a view of some mountains to the south-east, apparently capped with horizontal sandstone beds. Here we entered on ridgy country, which we cleared in two and a-half miles. This belt of ridgy land is the divide of the York Peninsula. There are a few well-defined quartz reefs on the ridges.

Our course lay for the next five miles over flats, which got poorer and poorer as we advanced. We feared having to make a waterless and grassless camp. Just before sunset, however, we found a swamp and some burnt feed near it, and camped. [Camp 46.]

Between the Coleman and the dividing ridge the land is pretty fair—gently rolling downs, well watered and well grassed. The decomposition of the granite on the spot forms a soil of much better quality than the decomposed granitic "cement" does. The prevailing trees are stringybarks, bloodwoods, a few ironbarks, and a few whitegums; on the ridges of the divide, ironbarks predominate.

September 23.—On leaving Camp 46, we crossed in two and a-half miles to the left bank of a chain of deep, narrow waterholes, running south-south-east (a continuation of the swampy watercourse on which our last camp was pitched). The waterholes abounded in fish. From the camp to this point the land was good, with a fair soil and fine patches of burnt grass on frequently occurring bottoms. The trees were whitegum, stringybark, box, and bloodwood, with a few ironbarks.

In half-a-mile more we crossed a second-magnitude creek, falling south-west, with granite on its banks and tea-trees in its dry bed. Fourteen bark gunyahs on the left bank.

In four and a-half miles more we crossed a dry river bed with a wide (dry) sandy channel, falling to the north-east. This river is wider than the so-called "Coen" or Kendall. In all probability it is the same as that known as Saltwater Creek on the road to the Coen diggings.

In a mile and a-half further we crossed a little byewash of the river, with waterholes. In a mile and a-half more, we crossed from the right to the left bank of a third-magnitude creek, running north-north-west. A mile further we recrossed the same creek, followed it up for half-a-mile, and again crossed to the left bank, when we found ourselves among low hills. I ascended one of these and got a good view ahead. Three miles to the south-west was the bluff of sandstone for which we had been steering since we crossed the divide on the previous day. Half-a-mile to the north lay what seemed to be the northmost cape of the sandstone-capped mountains. To the south-east there seemed to be low gaps in the sandstone wall, and tolerably clear country.

We then struck south-west (true) for half-a-mile across low granite country, and camped on a little gully, with water, running to the north. [Camp 47; bloodwood, broad-arrow, J, 23/9/79.]

The country traversed to-day, as far as Saltwater Creek, was level, and fairly grassed. Beyond the river, the land was only tolerably grassed and somewhat undulating.

September 24.—On leaving Camp 47, we beat about to the north and north-east for five and-a-half miles from cape to cape of the sandstone, in the hope of rounding the latter, as I had intended to map in the boundaries of this formation. I found, however, that it extended further and further to the north-east, so that I had to abandon that idea and seek a gap by which to ascend on the sandstone table-land. My reluctance to adopt this course was amply justified by the difficulties in the path, as well as by this decreased interest of the geology. The valley we followed up (east-south-east) came to a head in one mile, and presented a wall of sandstone about a hundred feet in height. It took us two hours to ascend this wall, the horses having to be unpacked and led one by one, while their loads were carried on our shoulders. With all our care, one horse missed his footing, and rolled down the slope among the rocks. Strange to say, he was but little hurt.

The sandstone here is highly ferruginous—a very hard, coarse grit with ironstone nodules and indistinct plant remains.

We

We were now on the top of what was named by Hann Jessie's Table-land. In half-a-mile east-south-east (magnetic), we crossed a valley falling to the left. After one mile more to east-south-east, half-a-mile south and half-a-mile east, we camped in a bottom with long grass, and a chain of holes, with very hard chalybeate water, falling to the south. A large nondah-tree loaded with ripe fruit overhung our tents. [Camp 48; latitude 15 degrees 8 minutes 18 seconds south.]

September 25.—Leaving Camp 48, we steered south-east (true) for eight miles, through well-grown close timber. The country was fairly grassed and closely timbered with very large stringybarks, ironbarks, and nondahs. It slopes gently to the north-east. We crossed no creeks of any consequence, only a few green "bottoms." The soil was reddish and sandy, as if derived from decomposed ferruginous sandstone; but not a single stone was seen. At the end of the eight miles was a gentle rise to the top of a ferruginous conglomerate bed, on which the timber suddenly changed to stunted tea-tree and brushwood. Thence to the end of the day's journey, the country was of the same description as that traversed for the first eight miles.

In five miles we crossed from the left to the right bank of a fourth-magnitude creek, with deep waterholes.

Three and a-half miles further we crossed a creek of the third magnitude, running like a mill-race to the north-east, three yards wide and eighteen inches deep. A cliff of very hard ferruginous sandstone overhung the left bank. I have no doubt that this is Mulligan's "Hann River."

In three and a-half miles more (with a fire raging on the right all the way) we crossed a fourth-magnitude creek (a tributary of the Hann), and camped on the right bank. [Camp 49; white gum, broad-arrow, 26/9/79.]

September 26.—We steered south-east (true) from Camp 49 through flat or gently-undulating country, with light-red sandy soil, fairly grassed, and with the same timber as on the previous day. In three and a-quarter miles from the camp we crossed a third-magnitude creek running north, with a small stream and large waterholes. Nine and a-half miles from the camp we crossed a slightly more pronounced undulation, on which a few small stones (ferruginous sandstone) were visible.

Nine miles further on we caught a glimpse of mountains on the left (higher beds of sandstone or conglomerate). In two miles more we passed a third-magnitude creek running feebly to the north, with deep lily-waterholes.

In a mile and a-half more we camped on a fourth-magnitude creek, with waterholes ponded back by ledges of horizontal sandstone. This camp was within half-a-mile of the mountains seen from the last creek. This and the creek last crossed are probably the heads of Mulligan's Warner Creek. [Camp 50; broad-arrow, J 26/9/79.]

September 27.—We reached the base of the range in a mile and a-half from Camp 50. The range is composed of horizontally-bedded gritty sandstone, white and yellow, with much peroxide of iron, which often segregates in concretionary masses. At the point where we struck the sandstone range, it was penetrated by a mass of intrusive pink felstone.

Three miles in a generally south-south-east direction took us through the sandstone range (ascending about 200 and descending about 300 feet) to a pack track (the first road from Cooktown to the Palmer) on the left bank of the Kennedy River. We followed the track, which led east (true) for a quarter of a mile, south-east for a quarter of a mile (by lovely reaches of blue water between conglomerate walls), east-south-east for two miles, and north-east for one mile. Here the river goes north, and the track crosses it and joins the Palmerville and Cooktown dray-track on the right bank of the river. At the crossing the Kennedy has a sandy bed, with a shallow stream running about five yards wide.

The conglomerate in the valley of the Kennedy contains pebbles of conglomerate, quartzite, quartz, greywacke, slate, and a few of granite—in fact, it has all the appearance of having been derived from the waste of the underlying auriferous rocks.

The point where we struck the road was the camping-place known as the "Kennedy Bend," ninety-six miles from Cooktown. The road crosses the flat top of "Jessie's Tableland" in a general east-north-east direction to a point forty-five miles from Cooktown, where it rounds the "Battle Camp Range." This range rises to about 200 feet above the general level of the table-land, and is composed of greenish-grey, sometimes reddish, sandstones. The beds are to all appearance part and parcel of the "desert sandstone" series. Mr. Norman Taylor, who accompanied Mr. Hann's expedition as geologist, discovered some fossils in the Battle Camp Range, which were ascribed by Mr. Robert Etheridge, F.R.S., to the genera Hinnites and Ostrea.

At Battle Camp the blacks made a determined stand against the intrusion of white men on the first rush to the Palmer.

From Battle Camp to the crossing of the Normanby River (thirty-three miles from Cooktown) the road keeps a general south-south-east direction. On the left bank of the Normanby is a mountain-mass of grey granite, apparently of later date than the sandstone.

About eight miles from the Normanby, in a general south-east direction, the road drops down the last escarpment of the "desert sandstone," which is seen resting on nearly vertical shales and greywackes. Thence to Cooktown the road traverses (eastward) highly inclined beds of greywacke, slate, and quartzite striking north-north-west.

From the foot of the table-land I struck across country to the coal-mine which had been opened. by the energy of the Cooktown Railway League, and made careful notes and measurements underground

I found that the mine had been sunk on the 8-inch seam alluded to in my two "coal" reports, referred to at the beginning of this narrative. A vertical shaft 6 ft. 2 in. x 2 ft. 6 in. had been sunk to the depth of nineteen feet through the bottom of the coal. Then a drive 6 feet 9 inches long had been made to the dip, when the bottom of the coal had been cut. The coal was then followed in an underlie shaft for 14 feet 6 inches. The dip of the coal-seam averages 33 degrees, or 1 in $1\frac{1}{2}$. Down the underlie it becomes rather steeper, reaching 45 degrees in one place.

At

At the north end of the vertical shaft the section is as follows—the measurements being taken at right angles to the planes of bedding.*

Black shales, with *Glossopteris*, from surface to roof of coal.

1st. Coal—Good. 9 inches at upper side; 14 inches at lower side of shaft, with a parting of dark shale $2\frac{1}{2}$ inches thick at lower side, thinning out to $\frac{1}{4}$ inch at upper side.

Dark shale $5\frac{1}{2}$ inches.

2nd Coal—Impure, clayey, brittle, and short. Light in colour. Fragments of anthracite can be picked from it. Thickness at lower side $2\frac{1}{2}$ inches; at upper side 1 inch.

Dark shale 4 inches on lower side; 5 inches on upper side.

3rd Coal—Brittle, anthracitic. Five inches thick on lower side; $4\frac{1}{2}$ inches on upper side.

Grey sandy shales, 2 feet 7 inches.

Hard grey sandstone, 6 inches.

Sandy shale, 1 foot 6 inches.

Hard grey sandstone, $5\frac{1}{2}$ inches.

Sandy shale (thickness not seen).

At the south end of the vertical shaft the section is as follows:—

Black shale down to roof of coal.

1st. Coal { *Coal*—Good. 3 inches on upper side; $2\frac{1}{2}$ inches on lower side.
Clay, 1 inch on upper side; dies out on lower side.
Coal—Good. 6 inches on upper side; 9 inches on lower side. }

Dark shale, $7\frac{1}{2}$ inches.

2nd *Coal*—Brittle. $\frac{1}{2}$ inch upper side; 1 inch lower side.

Dark shale, $3\frac{1}{2}$ inches upper side; 5 inches lower side.

3rd *Coal*—Brittle, anthracitic, impure. 6 inches upper side; 7 inches lower side.

Dark sandy shale, 2 feet 7 inches.

Sandstone, 6 inches.

Dark sandy shale, 10 inches.

Sandstone bottom of shaft, 6 inches.

At the bottom of the underlie shaft the section is as follows:—

Solid dark sandy shale, 2 feet.

1st Coal { *Coal*—Good; 3 inches.
Black shale, 0 to 2 inches.
Coal—Good; 4 to 5 inches. }

Black shale, $4\frac{1}{2}$ to 8 inches.

2nd and 3rd *Coal*—Brittle, anthracitic; 12 inches thick at end of shaft, although interrupted by 8 inches of shale 2 feet from end.

We reached Cooktown on 3rd October.

SECOND EXPEDITION.

On the 15th October, 1879, I received a telegram from the Under Secretary for Mines as follows:—

"Minister for Mines wishes you to hold yourself in readiness to accompany party starting from Thornborough to prospect York Peninsula."

To my inquiries regarding the route to be followed and the time of starting I received the following reply:—

"Brisbane, 17th October, 1879.

"The prospecting party will start from Cooktown in about a month. Not earlier. Will prospect in direction and beyond locality lately visited by you. Will be fitted out for six months."

On 22nd October, 1879, the Under Secretary for Mines telegraphed:—

"Prospecting party in course of formation to start from Cooktown within month will consist of four white men, experienced prospectors, who will be fitted out for six months' trip, and will prospect for four months in localities north indicated by you as most probably auriferous. If unsuccessful up to that time, will then be allowed to prospect where they may fancy. Be preparing what you require as outfit, and advise this office when ready."

I reached Cooktown on 13th November, and the following instructions arrived by the same steamer:—

"Department of Mines,
"Brisbane, 7th November, 1879.

"*IN RE* PROSPECTING YORK PENINSULA.

"Sir,

"The prospecting party will be under your direction so far as relates to the localities that are to be prospected during a period of four months. At the expiration of that time, if the prospectors do not approve of the directions of Mr. Jack, they are to be at liberty to proceed by themselves; Mr. Jack and men to proceed with his geological exploration so long as his supplies, and other considerations, will permit.

"James

* By an ingenious method of measuring along the *face* of the workings the thickness of the coal had been much exaggerated in local reports.

"James Crosbie will be the leader of the gold-prospecting party—consisting of himself, Leeland, Hume, and Hamil; and, in the event of any difference of opinion as to their course of proceedings, the instructions of Crosbie are to be followed* by the other three. Crosbie will keep a diary of proceedings, making an entry therein daily. In the event of the prospectors parting company with you and your men at the end of the four months, you will hand over such rations and other necessaries as you can conveniently spare from your supplies to Crosby and party, so as to enable them to remain out prospecting as long as possible.

"The whole party will supply themselves with rations, &c., for a six months' trip.

"Everything supplied by the Government to Crosbie and party, Crosbie as leader will be held responsible for, and it is to be returned, or satisfactorily accounted for, to the Police Magistrate or Warden of the district where the party is broken up.

"The primary object of the expedition is to discover on the Peninsula an alluvial gold field, to which object you will specially devote your knowledge, at the same time taking every opportunity to make a general geological survey of the country passed over, without in any way delaying the party in its main purpose—that of prospecting for gold. The time of the party must not be expended in searching for quartz reefs, although notes should be made of any auriferous reefs accidentally discovered. The prospecting party, consisting of Crosbie, Leeland, Hume, and Hamil, will be each equally entitled to retain all gold found by them, the usual reward claims, and any reward payable for gold discoveries, provided that they each use their best endeavours to secure a successful issue to the expedition.

"I have, &c.,

(Signed) "Geo. L. Lukin,

"Under Secretary for Mines.

"R. L. Jack, Esquire,

"Government Geologist, Cooktown."

The prospectors objected to these instructions, that they appeared to give me too much power over their movements, and imagined that I might obstinately keep them prospecting for months in a locality which they might not think good enough. To their remonstrance they received, by telegraph, the following reply:—

"Brisbane, 18-11-79.

"Your telegram 14th Prospectors are not under control of geologist and leader not subordinate to him Read instructions again You have separate outfit and are entirely independent of Mr. Jack Mr. Jack takes the opportunity of party going out to accompany it for the purpose of making geological notes of the country travelled over and to render any assistance in his power to the party but is instructed to make his geological surveys subordinate to the main object of the expedition that is the discovery of alluvial gold-field The only authority he has over the prospectors is that he shall direct what country shall be prospected for the first four months Consult Mr. Jack and you will find all matters can be satisfactorily arranged between you.

(Signed) "Geo. L. Lukin."

A copy of the above telegram was sent to me, and I replied on the same date:—"Quite ready for my part to carry out instructions of 7th instant which seem fair reasonable and workable."

On talking the matter over with the prospecting party, we were mutually satisfied with the arrangement made in the Under Secretary's last telegram—that the localities to be prospected were to be indicated by me for the first four months, and that the prospectors were to be sole judges of how much time should be spent on each. I had no doubt that the prospectors and myself would agree on the latter point.

When the first intimation of the proposed expedition reached me I felt it my duty to represent to you the necessity for a small escort of native police.

"Recent experience leads me to suggest that an officer of native police, with a few troopers should accompany the party, for the double purpose of protecting the horses and taking charge of the relations of the blacks and whites. This would prevent, I believe, the difficulties likely to arise should the prospectors be compelled to take the law into their own hands. It would add nothing to the cost of the expedition, as the outfit of the troopers has already been provided for, and their rations and pay run on equally whether they are employed in active service or not."

The suggestion was not complied with.

My party consisted of Joseph J. Macdonald, James S. Love, and Charlie, a Townsville black.

We reached Cooktown on 13th November, 1879, and a week was spent in completing our outfit. Having made arrangements for our stores to be sent by boat up the Endeavour River, to Barratt's Landing, we camped in Webb's Paddock, on the left bank of the Endeavour River, thirteen miles from Cooktown.

On 26th November we left Webb's Paddock, and followed the Escort-track (on the north side of Cunningham's Range) for eight miles. The prospectors had a serious mishap on starting: a pack-saddle being broken, and Crosby's "spare" pair of boots lost. One of their pack-horses (a mare) gave a deal of trouble. Crosby and Leeland had to camp with it, and did not overtake the rest of the party till the following morning.

November 27.—We continued our journey, the Escort track joining the main Palmerville Road at the foot of the table-land referred to in the foregoing Report. After sixteen miles of travelling we camped on the left bank of the Normanby.

November 28.—Travelled (twenty-two miles) from the Normanby to the Welcome Waterholes. On the way I tried once more to discover the fossiliferous locality in the Battle Camp Table-land—with much toil, but no success. I climbed up five separate gullies, one of them being that which was indicated to me by Mr. A. C. Macmillan—viz., the first beyond Battle Camp.

November 29.—Welcome Waterholes to Laura Telegraph Station (13 miles). The 30th being Sunday, we spelled the horses and wrote letters. Here we got two kangaroo dogs, one from the native police and one from Mr. H. R. Jones.

December

* The prospecting party had misread this passage, and till four months later, when we happened to compare our copies of the instructions, were under the impression that in case of difference of opinion the instructions of their leader were to be "foreclosed" by the other three. It is satisfactory to be able to say that they worked harmoniously together in spite of this misunderstanding.

December 1.—Travelled from the Laura Telegraph Station to a gully two miles east of Carter's Grave (18 miles). There had been rain here lately, and the grass was lovely.

December 2.—Came on to the "Kennedy Bend," and camped on the left bank of the river (i mles). [Latitude, by observation of Canopus, 15 degrees 34 minutes.]

December 3.—We left the Palmerville Road in the morning, and travelled up the left bank of the river by the old road, till we had rounded the south end of the sandstone range, about two miles south of our return track on the previous trip. (South-west 1 mile, west-north-west 2 miles, north-west ¼ mile, west ¼ mile to the point where we struck the old road on the previous trip, and 2 miles south, 10 degrees west to the end of the range.) My intention was that the party should strike the Peach River at or below the Geikie Range, a course which would take us through new country to the west of my old track and give us an additional chance of success, should the Geikie Range prove auriferous.

In six miles north-west (true) we crossed a creek of the fourth magnitude with a chain of lily-covered waterholes. This, I have no doubt, is the same chain of "lily waterholes" which we passed two miles north-west of Camp 50, on our last homeward route.

From the lily waterholes we held west 30 degrees north (true) for ten miles, and saw no more water till we found some in holes in a narrow bottom which we had followed down on our course for two miles. We camped on the left bank. The night was too cloudy for observations. [Camp 1.]

The country traversed this day was soft and sandy and very gently undulating. The sand was for the most part white, being derived from the decomposition of white sandstone.

December 4.—In half-a-mile down the hollow on which we had camped we came to a deep (but not running) creek of the third magnitude falling to the north, doubtless the same that we camped beside on 25th September.

Three miles further, through rather close brush, we crossed a deep and narrow sandy creek of the third magnitude, running strongly to the north-east. Three and a-half miles further a somewhat larger creek was passed. It was running very strongly, with sandstone ledges and long, canal-like reaches, and was difficult to cross.

The last two creeks were so obviously of the same character as Mulligan's Hann River that I had no doubt of their identity. The river had bifurcated between the present and the lower crossing (see 25th September).

In seven miles more we camped on a marshy bottom. [Camp 2; Moreton Bay ash, J/4/D/79.]

The country traversed to-day was more undulating than that of yesterday, or than the corresponding stage last trip. It was also, on the whole, less sandy than yesterday's stage, and a few stones were seen in the soil. The soil was derived from the decomposition of a red ferruginous sandstone.

December 5.—We had hardly started when we got into broken, stony, sandstone ridges, having a total ascent of about 500 feet (reddish ferruginous sandstone), intersected by deep gullies. In five miles we reached the edge of "Jessie's Tableland," and had a view ahead on our course. We could make out some low hills with a few pinnacles, apparently about the Coleman.

We found it very puzzling to get down off the table-land, for although we circled round for some distance we always found a cliff below us. We hit on a place at last where we could get down, by leading the horses one by one.

The sandstone rests on granite, huge boulders of which dot the valleys like gigantic ant-hills.

On descending from the table-land, we found ourselves in the valley of one of the heads of Saltwater Creek. Our course lay down the valley for a mile and a-half to the north-west (true), and then over level granite country for seven miles more to a second-magnitude creek, with two dry channels, falling to the north (the principal head of Saltwater Creek). After much search a little water was found in a hole, which was deepened and made to serve for the men and horses. [Camp 3; poplar gum, J/5/D/79. Latitude, by observation of Canopus, 15 degrees 13 minutes south.]

In the valley below the table-land we passed the bower of a "bower-bird"—a rough arcade of hay two feet in length and one foot high (almost meeting at the top) with pebbles from the conglomerate, land-shells, and fragments of bleached bone strewn over the bottom of the bower and on the ground at its two entrances.

December 6.—Last night a native's track was seen in the bed of the creek. He had come as far as our waterhole and turned back down the creek.

In the morning four of our horses were missing. They had travelled some distance, and our start was delayed in consequence. Waterholes were seen in the creek about a mile below the camp. We found the creek flanked on the left bank by two byewashes with waterholes in "cement."

In a mile and a-half we crossed a second or third magnitude creek (another branch of Saltwater Creek) falling to the north-east. Its bed was dry, but a byewash on the left bank had waterholes in "cement." On the left bank was tea-tree brush, pandanus, and grass-tree.

Four and a-half miles further a dry third-magnitude creek was crossed, falling to the north-east.

The next stage of four and a-half miles was well grassed, and well watered by numerous unnameable and unmapable gullies.

From the table-land to this point the whole of the country had a granite bottom. Here the granite gave place to mica-schist, gneiss, and quartzite, with a north-west and south-east strike. A good deal of quartz lay scattered about. The change was marked by the beginning of a tract of low, broken country, not deserving the name of a range, although it forms the divide of the Cape York Peninsula. The ascent amounts to about three hundred feet, the summit level being considerably lower than the sandstone table-land.

Eight miles through this ridgy country (the first three to west 15 degrees north, and the last five to west 30 degrees north, true) brought us to the left bank of a third-magnitude creek with waterholes, where we camped. [Camp 4. Latitude, by observations of Achernar, 15 degrees 4 minutes.]

December 7 (*Sunday*).—Spelling. A short but heavy thunderstorm before dawn. Frightfully warm day. More rain at night.

December 8.—A grey horse of Crosbie's had got a kick from some of the others and was unable to walk. We agreed to camp for a day or two and give him a chance while prospecting the neighbourhood.

December 9.—The horse was still unfit to travel. To-day and yesterday a good deal of prospecting was done in the creek and gullies, but no gold was obtained. With Macdonald I followed the creek down for some miles, but saw nothing of the Coleman, although this creek must be a tributary of the latter. I named it Crosbie Creek.

December

December 10.—We left Camp 4, the lame horse having now somewhat recovered.

In a mile and a-half the schist and gneiss country came to an end, and granite began. Half-a-mile further a third-magnitude creek was crossed, running north-west, with waterholes in granite. We traversed granite country gently undulating for the next five and a-half miles, when we mounted some ridges of schist and bluish quartzite. From these ridges a view of the ranges to north-west and north-north-west was obtained. In five miles more we reached the Coleman River, whose valley had been parallel to our course (north-west) for the last two miles. The bed of the Coleman was dry, but we found water in lagoons on the left bank, and camped. On the right bank were ridges of slate striking north-west. [Camp 5; bloodwood, J-10-D-79. Latitude, by observstion of Achernar, 14 degrees 54 minutes south.]

December 11.—We struck due north from the Coleman. After three miles through level country we crossed some low, grassy ridges of porphyry, timbered with bloodwood, and shortly afterwards passed a dry second or third-magnitude creek, falling to the south-west. The prospectors tried this creek, but found no gold. Ferruginous gneiss, greywacke, and quartzite (the latter granular, evidently a not much altered sandstone) were the prevailing rocks.

In two miles more, among ridges of schist and slate, striking north and south, with coincident quartz reefs, we passed a pinnacle of siliceous greywacke on our right. The greywacke was traversed by numerous and large north and south reefs, generally bluish-white and vitreous. From the reefs I carried away a quantity of brown ironstone, but on being crushed and washed it yielded no colours.

The next three miles were in ridges of greywacke, slate, and quartzites, with many iron-stained quartz reefs, which I should have liked to spend some time among, as they appeared like auriferous reefs.

For three miles more we traversed rolling downs of slate, weathering yellow. Here our course was changed to north-west.

In a mile and a-half (rolling downs of slate and greywacke striking north-west) we crossed the confluence of two dry creeks of the third magnitude, falling south-west. Our course was here altered to north-north-west, and in three and a-half miles (slate and greywacke) we found a little water in a fourth-magnitude creek falling to the south-west, and camped. [Camp 6. Cloudy. No observation.]

December 12.—We held north 20 degrees west for a mile and a-half, and north 15 degrees west for three miles over rolling downs (ironbark) to a dry fourth-magnitude creek, which we crossed, left to right bank. We then ran down the right bank of the creek for one mile on the same course, when the creek struck out to the north-west, and we continued our course (north 15 degrees west). An outcrop of ferruginous mica schist was seen where we left the creek. In half-a-mile more we crossed the King River. It had a large, dry, sandy bed, with several channels, almost choked up with tea-trees.

I ascended a porphyry hill on the right bank and had an extensive view. There is a range of very high mountains down the valley to the west.

We continued for a mile and a-half north 15 degrees west over ridges of ferruginous mica schist, with low summits of porphyry on the right. For another mile and a-half, on the same course, we kept the crown of a low ridge of ferruginous mica schist containing long felspar crystals. A high range lay parallel to our course about a mile to the right, and a still higher (rocky, apparently, porphyry) two miles to the left.

In one mile more we camped on the left bank of a fourth-magnitude creek, falling to west-south-west, with a little water and good grass. [Camp 7; gum, J/12/D/79. Latitude, by observation, of Achernar and Canopus, 14 degrees 34 minutes S.]

December 13.—We struck north 35 degrees west from Camp 7. In three-quarters of a mile we crossed a fourth-magnitude creek and began to ascend to a high granite table-land. In a mile and a-half on the table-land, where a few quartz reefs were observed, we crossed a small boss of dolerite or basalt, on which the sudden improvement of the grass was very marked.

In one mile further we crossed a fourth-magnitude creek falling to the south, and observed slates and greywackes on its right bank striking north-west. The creek which we left in the morning, and all the others crossed up to this point, unite to form a tributary of the King. In one mile, zigzagging to the north-west, we passed through a gap (porphyry) in the divide between the King and Lukin Rivers.

For three miles we descended gently a wide, grassy valley to north 10 degrees west, with high ranges of porphyry on the left, and a lower range on the right, and crossed a creek falling into the left bank of the main creek in the valley. For a mile and a-half north 6 degrees east we kept the left bank of the creek, which had a very winding course and was fringed with scrub. We found water in the creek here and camped. [Camp 8; bloodwood, J/13/D/79. Latitude, by observation of Achernar, 14 degrees 28 minutes S.] I named this creek after Macdonald.

December 14.—We did not move camp to-day, as the prospectors wished to examine the country, which they did, but without success. I ascended the range forming the left wall of the valley. Quartzite and greywacke, with intrusive porphyry, predominate on the hills, while slates and mica schists occupy the valley. The right wall of the valley is also composed for the most part of slates and mica-schists.

December 15.—We continued our journey due north down the Macdonald Valley to its junction with the Lukin River (seven miles). The creek has extensive alluvial flats, with beautiful grass. There are large and numerous waterholes from our Camp 8 downwards. The soil is reddish, from the decomposition of ferruginous mica schist. The Macdonald Valley would make a fine cattle run, as there is fine country (in a grazier's sense of the word) from the source to the mouth of the creek, as well as in several parallel valleys.

At the mouth of the Macdonald the Lukin falls to west-south-west. We only saw one small waterhole in a wide, sandy, bed overgrown with tea-trees, and divided into four or five channels.

On crossing the Lukin two gins were surprised. One made her escape, but the other took to a tree, which she ascended or descended with astonishing agility, with her hands and the soles of her feet only, as her fears increased or diminished. She was very suspicious, and apparently very indignant. She scolded us violently and pointed in the direction in which her companion had fled, at the same time squeezing her breasts as if to indicate that she was or might be a mother. She had curly hair and a front tooth knocked out. The want of a front tooth is said to be a characteristic of the coast tribes in the north. She had no clothing, but left a dilly-bag with a few roots at the foot of the tree, together with a long climbing-vine and a tomahawk made from a pick cut through at the thickest part and hefted with a cleft stick.

From

From the Lukin we kept due north for six miles, the last three with hills appearing occasionally on the left. The country was generally flat, with stringybark and bloodwood. Occasionally we crossed tea-tree flats with the "graveyard" anthills. We crossed two gullies with water. At the last of these we camped, as a thunderstorm was impending. [Camp 9. Latitude, by observation of Achernar, 14 degrees 13 minutes 30 seconds south.]

December 16.—Some of the prospectors' horses having strayed, my party went on ahead. We steered due north for three miles, and north-north-east for two miles, till we reached some ridges from which the sandstone-capped mountains to the west could be distinctly seen. I wished to visit the sandstone range to see if there was any likely country behind it, and waited some time for the prospectors to come up, having heard Crosby's stockwhip two miles back. They did not, however, appear, and I moved on, confident that they would follow our tracks. It turned out otherwise, as they lost the track on the stony ridges where we changed our course. They kept on the same course, believing that we would make for it to rejoin them.

Three miles due west brought us to the nearest point of the sandstone hills. They turned out much lower than I anticipated—only 200 feet or so above the level of the plains. Only a thickness of about 50 feet of sandstone was seen. The sandstone was ferruginous and very hard. It contained little pebbles of quartz, and large ones of slate and quartzite. It appeared to be partly composed of fine volcanic dust.

A granite mountain, higher than the sandstone range, extended from near our Camp No. 9 to the Lukin River.

From the sandstone range I got a fine view to the north and north-east, but was unable to see the country to the west.

On descending from the sandstone tableland we struck magnetic north (north 6 degrees east, true). In six miles we obtained from a low ridge a good view of the ranges at the Coen diggings. It was getting time to look for a camp, but water (which had been plentiful up to this point) was not to be had. We followed a gully from its head for eight miles down its windings—say five miles to the north—when we got a little water in a tributary gully. It was a miserable supply—a clay puddle swarming with tadpoles and frog-spawn. It took a good deal of straining through calico to make it fit for the tea-billy. We named the creek we had followed down Tadpole Creek. [Camp 10.]

The country traversed to-day was all granite, gently undulating, with stringybark and bloodwood timber, and a few poplar-gums. Occasional "graveyard flats," studdied with meridional anthills.

December 17.—Charlie having heard the bells of the prospectors' horses last night, he led the party in the direction from which the sound had reached his quick ears. In one mile east-north-east he came on the prospectors' tracks at the crossing of a third-magnitude creek. We followed the track due north, and in two miles arrived at the prospectors' last night's camp on the right bank of the same creek. In four miles north we reached the Coen, where we found the prospectors camped, and camped beside them on the right bank. [Camp 11. Cloudy; no observation.]

To-day's stage was all gently rolling country, with ironbarks and stringybarks.

A sharp thunderstorm and rain at nightfall.

December 18.—Accompanied by Macdonald I crossed the Coen, which at our camp ran west-north-west, and struck west. In two miles the river again came round to the line of our course, received a third or fourth magnitude creek, and again flowed to west-north-west.

For five miles more due west, we travelled over nearly level country, when we struck Tadpole Creek, here a large third, or almost second, magnitude creek. We followed it up for five miles, mainly to the south-east, but winding at times to the east and even north-east. It had a wide, flat, sandy bed in two or three channels, crossed at long intervals by bars of granite. We tried the creek in several places, but got not even "the colour" of gold.

We struck back north 28 degrees east, and in three miles crossed our morning's track in the gully, two miles from Camp 11. We crossed the Coen at the mouth of the gully, and got fine "colours" in the bed of the river. Between Tadpole Creek and the Coen we saw many quartz reefs, but they were white and unstained by iron oxide, and altogether of an unpromising appearance.

December 19.—We left the camp on the Coen River, Crosby leaving the lame horse behind. In four miles north 30 degrees west we came to a creek of the fourth magnitude, falling west-south-west, with water, on a granite bed. We washed three dishes of stuff here and got "colours" in each. The creek was joined a little lower down by a similar creek coming from north-north-east.

Three miles north 30 degrees west, through grass-tree country sloping gently to the left of our course. Granite, with much quartz, some of it iron-stained.

For two miles we gradually descended to the north-west, over well-grassed ridges of granite, with much iron-stained quartz. Hills were seen to right and left. We prospected in gullies among the ridges, but got no colours.

For six miles more, west 40 degrees north, we traversed gently undulating, well-grassed country with reddish soil, when we came to a rise showing for the first time an outcrop of brown and yellow sandstone.

In six miles more on the same course, across rough, stony, barren, sandstone ridges with sharp gullies and scrubby brushwood, we camped at nightfall on a gully falling to the north. [Camp 12.]

There was a smart thunder-shower while we were travelling through the well-grassed low country.

December 20.—After we had travelled downhill for three miles to the north, granite was seen in a gully. Thence the country rose slightly, and we crossed five miles more of sandstone country. Here we entered on rough sandstone ranges. As the sandstone appeared to extend for many miles to the north and west, we changed our course to due east.

In two miles, mainly downhill, we reached the edge of the sandstone country and emerged on the underlying granite, which was very coarsely crystalline, with orthoclase crystals two inches in length.

After one mile more to the east, we struck east-north-east, and continued for four miles, mostly down the left bank of a fourth-magnitude creek, over granite country with fine green grass and large picturesque boulders, to the Peach River, and camped on the left bank.

The

The river here differs thoroughly in character from what we saw higher up on the previous journey. It has a diffuse bed with about a dozen channels divided by tea-tree ridges. One large stream was flowing freely, only fordable at long intervals. The bed of the river was plentifully strewn with granite boulders, and showed bars of the same rock. [Camp 13. White gum, "Peach," JxxD79. Latitude by observation of Achemar, 13 degrees 33 minutes 30 seconds S.]

Some Torres Straits pigeons were seen to-day for the first time.

December 22.—In the morning I went to an eminence ("View Hill") on the right bank of the river, one mile from the camp. (Quartzite on top striking north-north-east, ferruginous mica-schist on slopes, and coarse granite at base.) After Charlie had cleared the timber from the hill-top, I made an extensive series of compass observations. The Peach River could be seen for about fifteen miles below the camp, making its way through a gap in the sandstones of the Geikie Range. The sandstones of the Geikie Range were seen extending to the north-east and north. Birthday Mount lay south 40 degrees east, about twelve miles off.

Macdonald got "colours" in the bed of the river near the camp, while the prospectors got colours among the slate bars in the river above View Hill.

In the afternoon I went out with Crosbie and Macdonald. We crossed (in half-a-mile) to a creek or river which joins the Peach below the creek, and which we afterwards named Attack Creek. This creek is nearly as large as the Peach, with a channel equally wide, and with very high flood-marks. It carries a running stream about half the volume of that of the Peach. In the bed of the creek opposite View Hill (at the junction of granite with gneiss and bluish micaceous greywacke, striking north and south), a few fine "colours" were obtained.

About a mile higher up the creek (to the east) the country changed to ferruginous mica-schist, slate, and greywacke, striking north-east and dipping generally to the north-west.

We next visited a hill which bore east 43 degrees south from View Hill. It was composed of quartzite, the intervening ground being mostly of slate or schist, weathering red and yellow.

December 23.—Leaving Camp 13 we kept the left bank of the river for two miles on a south-east course, and crossed to the right bank. (Ferruginous mica-schist, slate, and greywacke.) At the crossing were enormous heaps of mussel-shells accumulated by the natives. We then kept the right bank of the river for five miles more on the same course, when we crossed a third-magnitude creek near its confluence with the river. A little beyond this creek a native camp was surprised. Two gins and four men ran away, leaving behind them a whole armoury of spears barbed with iron and kangaroo bone.

We continued our south-east course for six miles more over soft decomposed granite country, the river lying about two miles to our right, and crossed a running creek of the second magnitude coming from the east. Some horse-tracks were seen on the right bank of the creek, in all probability belonging to Donald Lang's party, who were known to be out prospecting in the same region. Love had heard a shot on the 21st, while engaged in cooking at our Camp No. 13 on the Peach. From subsequent comparison of dates, there remains no doubt that Lang's party and ours were within a short distance of each other at this time, although we did not chance to meet.

From this creek we struck due south and in two miles crossed the Peach, and camped on good grass on its left bank. The river carried a running stream, but it was much smaller than at any of the places where we had seen it before. It was flanked with scrub and palms. *Zanthoria* on the left bank. [Camp 14. Latitude by observation of Achemar, 13 degrees 37 minutes.]

December 24.—In one mile south-east up the left bank we crossed the river and struck eastward, passing by the south side of Birthday Mount in two miles. Four miles further we crossed from the right to the left bank of a third-magnitude creek, coming from the mountains to the north-east (Irvine Creek).

From Irvine Creek we struck south-east. In two and a-half miles we saw Lang's (?) tracks, going north-west. In a mile and a-half more we crossed (right to left bank) a dry fourth-magnitude creek, and, half-a-mile further, another, which was afterwards named Beetle Creek.

In a mile and a-half more we crossed a deep palmy creek of the first magnitude, with large waterholes, and camped on the left bank. We named this Christmas Creek. [Camp 15. Moreton Bay ash, J., Christmas, 79. Latitude by observation of Achemar, 13 degrees 41 minutes.]

The whole of this day's stage was poor sandy granite country, nearly flat and poorly grassed. Grass-trees, pandanus, tea-tree, and small brushwood.

December 25.—In company with Mr. Crosbie, I ascended a hill about one mile north 18 degrees east from the camp and took a series of compass observations. The hill was of granite, with quartz reefs containing much decomposed pyrites. We next visited my old Camp No. 39 of last trip, which is just below the junction of Christmas Creek with the Peach. The two streams are about half-a-mile apart at our present camp. In crossing the Peach here my horse slipped on a root, and in plunging knocked me off against a bough and damaged the stock of my rifle. I was faint and giddy for a short time from the stroke of the bough across my abdomen, but I was surprised to find that I had sustained no serious injury.

The prospectors and Macdonald got fine colours in Christmas Creek.

In the afternoon I plotted up the route and observations. Crosbie was out up the valley of the Peach. He fired a shot at a mark, and presently five signal fires sprang up in various parts of the scrubby hills—a circumstance showing that the aboriginals were watching our movements closely.

December 26.—We left Camp 15, and struck east-south-east. In a mile and a-half we arrived at the Peach River. The valley was here very narrow, and choked up with dense scrub. The prospectors cut a track, and we crossed to the left bank of the river. We kept the left bank south-east, east-south-east, and east for a mile and a-half through scrubby country, when the valley again narrowed, and we camped on a little open pocket. [Camp 16.]

Hume got somewhat coarser gold here than any yet obtained, but there is very little wash, the violence of the brawling torrent having carried it all away.

Crosbie and I went out on foot to spy the nature of the country up the river. For two miles (east-south-east) we kept the bed of the river, which rose in these two miles at least 500 feet. It was a rushing torrent over bare rocks and among boulders. At the end of the two miles the river branched,

the

the two beds being of about equal size, but the southmost having much the larger stream of water. We ascended a nearly bare ridge (about 800 feet high) between the two branches of the river. A quarter of a mile up the river brought us abreast of one of the most imposing waterfalls in Queensland. A sheet of white foaming water dashed down from a large tributary over the left wall of the valley of the southern branch of the Peach. There must be a fall of at least 500 feet in a quarter of a mile.

In a quarter of a mile more we reached the summit of the ridge, and could see to the east for about two miles over scrubby mountains with a fringe of large hoop-pines standing up against the sky. This range, forming the divide of the peninsula between the heads of the Coen (or Kendall) and the Peach on the one hand, and the east coast on the other, I named the McIlwraith Range, in honour of the present Premier.

The banks of the river and of all its tributaries were clothed with dense scrub with palms and vines. The latter made travelling very toilsome and even painful.

Coming home we crossed the northern branch of the river, and came down the ridge on the north side to the camp.

The defiles of the river, and almost all the high country crossed on foot, were composed of a fine-grained grey granite, with black mica, and singularly devoid of reefs. It is evidently not from this quarter that the gold in the lower reaches of the river has been derived. My firm belief is that it must come from well back on the table-land, and that only fine light gold has been able to escape through the gorges into the low country.

December 27.—Leaving Camp 16, we got up on the table-land by the spur on the right bank of the Peach, an ascent of about 800 feet, over open ridges timbered with box, bloodwood, and ironwood, with a few ironbarks. The gullies were scrubby, with some hoop or Maryborough pines. After a sinuous course for five miles in a general east-north-east direction, we camped on a ridge on the left bank of a gully (with a little water) falling into Christmas Creek. [Camp 17. Mahogany tree, J/27/D/79.]

About a mile back from the camp some reefs were seen, containing galena and iron oxide. They were considered very "promising," but yielded no gold on being crushed and washed.

December 28.—The horses were all abroad in the morning, the rank grass at the camp not being to their liking. One of ours had gone back nearly to Camp 16, and it was late in the afternoon before the last of Crosbie's was recovered. I went with Charlie to a mountain (mica-schist, with numerous reefs on the eastern slope) between the Peach and Christmas Creek, to see if there was any practicable route to the east. The only way at all open was to south-south-east.

December 29.—Leaving Hamil and Love in the camp, we went out to the south-east to try to penetrate to the upper reaches of the Peach—Crosbie, Hume, and Layland making the attempt by another route. We threaded our way through openings in the scrub for about four miles, to the right wall of the valley of the north branch of the Peach (above the defile previously visited). Here we came on the prospecting party at the further end of a pocket, and as it was now evident there was only one (if any) way we kept together for the rest of the excursion. With a good deal of trouble a path was partly cut and partly found through the scrub sidling down the wall of the valley into an open plain, which we crossed (quarter of a mile) over to a tributary (a third-magnitude creek) of the north branch of the Peach, on which we camped. [Camp 17a, J.C. 79.]

The creek, which was running, with a bed full of boulders on bare granite bars, was prospected, but without success.

Crosbie and I went on, over ridges lightly timbered but flanked by densely scrubby gullies, about one mile southward to the north branch of the Peach River, above the hill which we had reached on the 26th. We found a strong current running, apparently quite as large as below the defile, and yet above the defile it receives both the south branch and the creek with the large waterfall. The bottom was of granite, to which the detritus carried over it by the current had imparted a fine polish.

From the size of the river here I should not expect to reach its source for twenty miles at least, and yet its course is so tortuous, the country so hilly, and all the watercourses, large and small, so equally clothed with scrub, that it was impossible to trace the valley for half-a-mile, even from eminences from which an extensive prospect could be obtained. The river could, as a rule, only be approached by cutting paths through the scrub—taking the chances of finding that one had been cutting to the river only to some insignificant gully.

Hume and Layland went to the river in the afternoon and prospected; they got only fine "colours" of gold. They reported that where they were the rocks in the bed of the river were washed quite clean, and that the current was so rapid that "quicksilver couldn't stay."

December 30.—At 8 o'clock last night heavy rain began to fall, and it continued till 8 this morning. The wet season had set in.

We packed up to continue our course up the river, if practicable. The rain ceased as we started and held off for the greater part of the day, although the sky was dull and threatening. We kept beating about to east and south, among openings in the scrub, or cutting our way through it, and succeeded in reaching the base of a pine-crested range, round whose eastern end the river appeared to come. We found that we were here within the drainage area of the "Falls branch" of the Peach, on one of its tributaries running about a "sluice-head of water." We then made for the main river, and struck it at a waterfall, which discharged itself into a huge cauldron, whose edges were alive with fresh-water crabs. There appeared to be open country on the right bank, but we were unable to cross, the bottom being smooth and bare and the banks very steep. We returned to where we had crossed the river before, and re-crossed it, finding that in all our wanderings we had only succeeded in making half-a-mile up the river. We tried to follow the open crests of the hills forming the right wall of the valley, but in a mile were baffled by the density of the scrub and gave up the attempt.

My hope was that payable gold might be found in the upper reaches of the river on the table-land, near the supposed source of the gold, and where the torrent was not impetuous enough to sweep away all its own detritus. We had not yet reached such a place if it existed. If there be such a place it must be beyond the pine-crested range where we stopped short to-day. I intended on the return journey to make another attempt by cutting paths for the horses in advance from camp to camp, as well as to try the unexplored country on the King and Lukin rivers to the west of our route.

Most

Most of the country traversed to-day and yesterday was of fine-grained granite, with some quartz—not very much, and not much charged with metallic ores. But there was quartz among the gravel of the river, whereas there was none in, and but little below the gorge.

On our return to camp 17 (about 3 p.m.), we learned that Hamil and Love had had a visit of the natives in force about two hours before. Love was baking at the door of his tent, when he saw twenty or thirty blacks, about 100 yards off, coming up the green slope towards the tents, talking and gesticulating eagerly. They probably had seen the bulk of the party leaving the camp yesterday, and thought that the two men left in charge were out, and had come to plunder. Love and Hamil fired at them, and pursued them as far as the gully. With characteristic Scottish *sang froid*, Love declared that he would have followed further but for the johnny-cakes, which he had left on the fire, and which he could not afford to have burned. Arrived at the green knoll on the further side of the creek, the natives shouted and danced, especially one tall fellow, whose "fling" Love very much admired.

We had just finished dinner, when the blacks again appeared on the opposite side of the gully. A tall native got on a green knoll about 600 yards off, and shouted and defied us with indecent gestures. Charlie and this champion harangued one another like Greek heroes. The substance of the miall oration was, according to Charlie (who must have gathered it from his gestures, for he understood nothing of his speech), that he might come over and join them, but as for the rest of us they had legions of friends who would come from all points of the compass and fall upon us. Only the one man kept in view, but from time to time he turned and addressed a crowd on the crop of the knoll behind him, and was answered by them in a kind of chorus of encouragement.

Crosbie, judging that the blacks would not have stayed and tried to "bounce" us unless they were in considerable numbers and meant mischief, put an end to the conference by firing a long shot at the spokesman, who dodged behind a tree with extraordinary agility, I believe before the bullet passed him, and vanished.

In the evening, to satisfy ourselves that the horses were safe for the night, we visited the knoll and its neighbourhood. We saw nothing of the blacks except the smoke of their camp-fires about three miles down Christmas Creek, where they were welcome to stay as far as we were concerned.

It rained heavily most of the night.

December 31, 1879.—Heavy rain all day and nigh the party engaged in horse-shoeing, writing, mending harness, and odd jobs.

January 1, 1880.—Showery all day.

January 2.—We left Camp 17, and retraced our steps by Camps 16 and 15 (eight miles). The Peach was scarcely swollen; but Christmas Creek was running strongly, so that we were almost aswim at the crossing, where there was only a shallow waterhole when we crossed before. From Camp 15 we skirted the range (north one mile, and north round to north-east one mile and a-half) into a valley bearing east 41 degrees south from Birthday Mount, and went up the valley for one mile to the north-east. We camped on the left bank of a running creek of the fourth magnitude (Beetle Creek), with scrubby banks, figs, palms, and vines. [Camp 18.]

After we had camped, I ascended the hills on the right bank of the valley to reconnoitre. I went up a scrubby spur to a hill about half-a-mile north-east of the camp, and found that stinging-trees were very plentiful. This hill bears north 41 degrees east from Mount Croll. Crosbie joined me here, he having ascended by another spur. On the way up he disturbed a native, who was in the act of lighting a signal fire. We followed the bare grassy crest of the right wall of the valley of Beetle Creek (the sides and bottom being very scrubby) for a mile to north 36 degrees east, when we came in sight of Camp 17, bearing south 36 degrees east, and about five miles distant.

The hills on the right wall of the valley were of granite, with black mica and orthoclase felspar. There were a few reefs of quartz, and some of mixed quartz and orthoclase felspar.

We had allowed ourselves to go too far before night overtook us. It was very difficult to get home in the dark, down the steep slope of the valley, which was strewn with boulders and dense with scrub, the latter infested with stinging-tree.

There was heavy rain through the night. About supper-time we were suddenly invaded by a plague of small beetles, which drowned themselves in the tea, swarmed the meat and sugar, ate holes in the saddle-cloths and pack bags, and crawled over our persons in legions. The nuisance abated somewhat towards the morning.

January 3.—The rain continued till about midday. We packed up and left Camp 18 at half-past 2. We had just left, however, when the rain recommenced. We had a miserable day's travelling, and were in constant fear of flooding or bogging. We made about seven miles to north-west, north, and north-east, round the right wall of the Beetle Creek valley, into the valley of Wilson's Creek. Wilson's Creek was flooded when we crossed it. Luckily the rain stopped just before we camped on Wilson's Creek (although the creek rose higher afterwards), and there was no more during the night. [Camp 19.]

January 4 (Sunday).—This was a fine "drying" day, which was much needed. I ascended the mountain on the right wall of the valley. This mountain bears north 26 degrees east from Mount Croll.

Troubled by a doubt whether this Wilson's Creek was not really the main head of Irvine Creek, I ascended in the evening a hill on the left wall of the valley, and satisfied myself that Irvine Creek came out of another valley between Wilson's Creek and Birthday Mount. Beetle Creek and Wilson's Creek are tributaries of the Irvine.

January 5.—A dull wet day. Before starting I had to adjust a quarrel between Macdonald and Love. They were on the worst possible terms for the rest of the journey. We travelled up the Wilson Valley to its head, about three and a half miles to east, north, and north-west. About two miles from our camp we saw four or five blacks at a camp beside a scrubby creek. We rode up to the camp, and the blacks got into the scrub. In the boughs of a tree were two bundles which we took to be corpses, from their smell and shape. While we were standing here some more blacks were seen sneaking up to us from behind the camp. We rode towards them and they fled, only one fellow appearing as if he had a mind to make a stand. No shots were fired. A quarter of a mile further another camp was seen to the right, and a few blacks. Love and Charlie rode after them till recalled. One dropped a spear in his flight.

There

There was not much of an ascent to the divide between the valley of Wilson's Creek and the next valley; but the travelling became rather difficult among intricate scrubby gullies, and very disagreeable owing to the rain and fog. Just about the divide we heard natives howling, apparently from a hill to the left, although they were hidden from us by a scrub. Crosbie's party, riding a little ahead of mine, saw some more blacks as they crossed a gully. We were just approaching this gully, the path being down a "point" towards which the scrub converged. Charlie had reached the point of convergence of the scrubs. The pack-horses came next, followed by Macdonald on the left, myself in the middle, and Love on the right. Without any warning a shower of spears came at us from the scrub to the left. One spear must have passed behind Macdonald's back (who was slightly in advance) and over my horse's neck. It stuck in the near shoulder of Love's horse (Moonlight), brushing my bridle wrist on its way. It was a narrow escape for Love, as a few inches back the spear would have transfixed his leg. He tried to pull the spear out of his horse's shoulder, but could not. We dismounted and fired into the scrub, but we never even saw the enemy, and could only guess at his whereabouts from the angle at which the spears stuck in the ground. While we were thus engaged the spear dropped out of Moonlight's shoulder and was lost in the long grass. It was afterwards found that one of the pack-horses (Poodle) had been grazed on the chest by a spear. Pursuit would have been useless in the intricate scrub and long grass. We camped about two miles down the gully (Attack Gully) to the north-north-west, in open country. (Camp 20). Heavy rain began when we arrived at the camp, and continued for the rest of the day. Our cartridges were much the worse for the wet, and were dried with considerable difficulty. We threw the wounded horse and probed and cut open the wound, but the spear (which could not have been barbed) had left nothing behind. It had glanced over the shoulder blade.

January 6.—This was a fine morning and we packed up and got away comfortably. We followed the gully for about a mile to the north, when it fell into a creek of the first magnitude (Attack Creek) coming from east-south-east. For a mile further to the north we kept the left bank of the creek, when, on its trending to west-north-west, we crossed it and continued our journey northward. Attack Creek is one of the heads of the large creek which falls into the Peach below our Camp 13. It was a little flooded when we crossed, and had rather more water in it than the Peach at our upper crossing.

For two and a-half miles to the north, after crossing Attack Creek, we had very disagreeable travelling, fearing every minute to be engulfed in boggy "graveyard flats," till we crossed a creek (Skae Creek) flowing to the west, with scrubby banks.

In a mile and a-half more to the north we had reached the range which formed the right wall of the valley of the Skae and Attack Creeks. Here the rain began to fall heavily, as it continued to do for the rest of the day and most of the night.

We skirted the range to the north-west for two miles, when we crossed a third-magnitude creek coming out of a deep valley in the hills to the right. This creek was remarkable for magnificent Leichhardt-trees among its scrub timber.

One mile and a-half north-north-west from this creek (crossing a fourth-magnitude creek with quartz boulders in its bed) we came to another point of the range. The rock here was slate and greywacke with much quartz. We rounded this point (from north-west to east for two and a-half miles) to a fourth-magnitude creek. In one mile more to east-north-east we camped on the right bank of a creek of the fourth magnitude. [Camp 21.]

January 7.—It rained heavily till it was too late in the day to make a start. We did our best to clean and dry our harness, stores, clothing, and blankets. In the afternoon I went on foot over the hills to north-east and south-east of our camp. The hills were of fine-grained granite in the central axis, and slate and greywacke with much quartz (cavities coated with peroxide of iron) on the outstanding spurs. When the mist cleared off I was able to take an extensive series of compass bearings. View Hill near our 13th camp lay due west.

January 8.—We determined to penetrate, and, if possible, to cross the McIlwraith Range by a valley which we had seen from View Hill, and on whose waters we were now camped.

We rounded a point of the hills (from north-west to north) for one mile, and thereafter kept a general course of east 29 degrees north.

In two miles we crossed a third-magnitude creek (named the Falloch), draining the north side of a granite mountain which we named Ben Lomond, as it bore a strong resemblance to the mountain of that name in the Highlands of Scotland. Crosbie got touched with stinging-tree in the scrub on the north side of the creek. A lump like a hen's egg rose immediately under his arm, and he sickened and streamed with perspiration. By the end of the day, however, he seemed little the worse. The horse which Layland rode also got stung, and was very restive for the remainder of the day.

The valley of a larger stream (which we named the Geikie) lies a mile or two to the north of the Falloch, and forms the principal head of the stream falling into the Peach below our 13th camp. The Falloch joins it about four miles below where we crossed it. Skae and Attack Creeks converge to form another large tributary joining the Geikie about eight miles below the mouth of the Falloch.

In one mile we crossed a third-magnitude creek in the same valley as the Falloch.

In a mile and a-half more we passed to the right of a little granite hill, which I ascended, and which afforded a magnificent view. I took an extensive series of bearings. We could see through the gap to the east a number of lofty tops, which I named the Macrossan Range. Here the rain began to fall heavily.

We went on for three miles to the east, and after crossing two creeks of the fourth magnitude camped (in the rain) on the right bank of a third—one of the heads of Geikie Creek. [Camp 22.]

January 9.—We had rain for the greater part of the day. We got across the divide, travelling, about ten miles in all, a little to the south of east. At first we crossed easy grassy ridges, often treeless, sometimes timbered with stringybark, bloodwood, and *Cycas media*.

We had just got on the eastern waters when the prospecting party, who were riding a little ahead, were mobbed by a troop of natives, whom they attacked and drove off.

About two miles further we had to descend into a deep valley by a pocket leading down from the top of a spur, but ending in thick scrub. The cutting of this scrub caused a short halt below the brow of the hill. I cast many an anxious look behind, but grudged to take any of the wearied horses back up the

the hill. All at once, without any warning, a spear came from behind and struck deeply in the off flank of the mare on which I was riding. She bounded forward, burst the girth, and threw me, scattering my note-book and maps (which, however, I recovered) among the long grass. The remainder of a parcel of pumpkin seeds, of which I had dropped a few at every camp hitherto, was lost.

Love, Charlie, and I went back on our tracks in pursuit of the snake-like enemy; but he had got into the scrub, and further search would have been useless.

We cut off the spear a few inches above-skin, and got the mare on to the camp with some difficulty. We had prepared to throw her, but she lay down quietly and submitted to have the spear head cut out without a struggle. The head was buried four inches deep, and had a bone barb about an inch and a-half long. She appeared in great agony and very sick, and died before morning.

Hearing the natives cooee after we had got into camp, Crosbie, Charlie, and I went back on our track to near the scene of the disaster, and waited for some time in the hope that they would show themselves, but they did not.

We camped on the left bank of a gully overlooking the valley dividing the McIlwraith from the Macrossan Range. [Camp 23.]

January 10.—We had packed up to move down into the open country in the valley to the east, and were having breakfast, when a party of blacks approached us from the hill behind (on our yesterday's track). They had spears in their hands, and shouted and gesticulated. Four or five of us ran up the hill to meet them. They advanced skilfully in "skirmishing order," dodging behind trees and rocks and taking advatage of every bit of cover, but those in the rear exposed themselves freely. We fired at those in the rear, killing one and wounding another. The rest vanished into the scrub. The one killed had been able to stagger back for about a hundred yards, into a gully to which we traced him by his blood. He wore a necklace of pearl-shell. When we had gone back to the camp to finish our packing we heard a loud howling, and on returning to the place found that the body had been carried away. We heard them afterwards in the scrub holding a sort of wake. By turns they chanted a harangue in a tone of lamentation, to which the others answered in chorus. They, no doubt, knew themselves to be secure in the scrub, where indeed it would have been quite useless for us to have followed them.

We went down into the valley to the east (Nisbet Creek). When we had gone about a mile we heard a great hallooing rise from our camp. The natives had probably found the carcase of the mare. We should have burned the carcase had time permitted, but as we could not wait till it was consumed, and as we knew that if we heaped a fire on it the meat would only be roasted by the time the natives appeared, we had to leave it to them. We also threw away the worst of our packsaddles.

We travelled across the valley of Nisbet Creek for about two miles in a general easterly direction. A path had to be cut through the scrub on the bank of the creek. We made for the north-west of two camp smokes which we had seen from our last camp. A party was just clearing out from a camp a quarter of a mile off when we arrived at our destination. Crosbie and Hamil rode after, but could scarcely get a sight of them. They left a number of spears behind, which were put in the fire. One of the spears was the ugliest weapon I ever saw. Its head was a little flattened, and edged with a row of chips of bottle glass let into grooves. It was enough to sicken one of savage warfare. I never saw flattened spear-heads among the Australian natives before, and I am inclined to think that the spear, or at least the idea, must have been derived from some of the South Sea Islands. A few hours later we found that the natives had returned to their camp and carried off their dilly-bags, nuts, &c. I was glad to think that their spears—especially the glass-headed one—had been put out of their way. We camped on the site of another native camp, abandoned in the morning. [Camp 24.]

Rain began as soon as we had pitched tents. The remainder of the day was spent in horse-shoeing, drying cartridges, and other odd jobs.

January 11.—The day kept fine till one o'clock, but it rained heavily for the rest of the afternoon.

In the morning Crosbie, Hume, and Hamil went back to Camp 23, and prospected in the gully below it. They got "shotty colours" in an alluvial flat. On their arrival they took out the packsaddle from the gully where he had left it, thinking to take it away to replace one of theirs. They were no distance, and not long away while prospecting; but on their return they found the saddle stripped of its cloth and hair and of all its iron, even to the brass-headed tacks. They found tracks following on ours to near our present camp. Strange to say, the carcase of the mare was untouched.

Yesterday afternoon we saw the blacks' camp fires spring up on a gully about half a-mile up the hill to the west of Camp 24. To-day, Charlie descried some natives crossing from one scrub to another by a bare patch on the hill side which commanded an excellent view of our camp. About 1 o'clock I made them out with the field-glass, standing in a group of five or six, with spears in their hands, on another bare spot near the top of the hill, at a distance which we guessed at about 1,000 yards, looking intently into our camp. They offered a good mark, and we deemed it justifiable in the circumstances to teach them that they were not safe even at that distance. Crosbie and I took good aim, and fired simultaneously. One black, either bolder than the rest, or astonished, or possibly wounded, stayed a second or two, but the others ran for the nearest scrub at a breakneck pace. Another dodged back in a few minutes and picked up a spear which he had left behind in his haste.

I believe that this long shot had a powerful effect on the mind of the natives. Even the death of some of their number had not deterred them, hitherto, from following and annoying us, but from this day forward we saw nothing more of them for two months, and, although we camped for a week within five miles of Camp 24, they never even came on our track.

Crosby and I had designed to ascend the hill where we saw the blacks, after dinner, to have a view ahead, but the heavy rain and fog which began shortly after put it out of the question.

January 12.—Crosbie and I ascended the hill in the morning. The blacks had moved their camp. We saw their smoke near the foot of the hill, half-a-mile to the south. From the hilltop we saw the sea, apparently only about five miles off, with low forest land intervening between it and the range. No. VIII Island was visible, its north end bearing east 34 degrees north, and ts south end east 32 degrees north.

On

On coming down we packed up and resumed our travels. We had heavy rain while we were on the way, but fortunately it was fair when we pitched our tents, which we did on an open ridge on the left bank of a creek which I named Hays Creek, about five miles in a general north-north-west direction from camp 24. Hays Creek (named after Mr. Walter Hays, of Townsville) falls into the sea opposite No. VIII. Island. [Camp 25.]

It rained most of the night. Macdonald was ill with fever and biliousness.

January 13.—Light rain and fog till midday. I kept my tent, plotting up the work. When the fog cleared, Crosbie and I ascended the hill to the east of the camp to get a view and plan our next move. The hill was of porphyry or granite, very poor in mica. The prospectors got colours in Hays Creek near the camp, above a waterfall. Hume and Hamil went down the valley of Hays Creek to the sea, crossing a mangrove swamp. There was a long sandy beach. They saw much iron-sand on the beach, but it yielded them no gold. They saw three piles of dugong tusks and some pieces of wreck. Layland went back about two miles on our yesterday's track, to a place where we had noticed some red-stained quartz reefs, but got no gold.

January 14.—Rain and fog. I went up the mountain which bore north 25 degrees from our camp, about three miles off, across the Hays Creek valley (which is marked in the Admiralty Chart as an "opening in the hills"). Between the creek and the mountain is a line of untimbered green hills running north and south. They are composed for the most part of granite, with a band of micaceous slate (weathering buff) on the east side. On the top is a large north-and-south quartz reef, apparently poor in iron. A parallel reef on the west side, however, has some "brownstone." The large reef crosses Hays' Creek to the mountain which Crosbie and I ascended yesterday.

The summit of the mountain is a "knife-edge" ridge, for the most part free of timber. There is a dense scrub on the eastern side only. For some distance north of the top, however, the scrub overlaps the western slope a little. From near the top I could see Cape Sidmouth (hilly) and the sandy spit to the north of the Cape; I had also a view of Ben Lomond, and the outstanding end (with the conical nob) of the left wall of the Attack Valley. I sketched the rivers falling to the north in the valley dividing the Macrossan from the McIlwraith range, their courses being clearly defined by dark scrub. The principal river, the Lockhart (so named from my own friend Mr. Hugh Lockhart, of Edinburgh), is skirted by large untimbered plains. Cape Weymouth was visible occasionally when the fog lifted.

The prospectors tried the gullies draining the hill which Crosbie and I visited yesterday, but got no gold; they then tried some gullies, tributaries of Hays Creek, beside the quartziferous ridges crossed in travelling from Camp 24. They got some fine colours, and one "shotty" grain of gold.

January 15.—Heavy rain almost all day. Messrs. Hume and Hamil tried the gullies below the green quartziferous ridges I crossed yesterday, but got only one fine "colour" of gold. In the afternoon Crosbie and I went across to a creek about three miles west of the camp, one of the tributaries of the Lockhart River, coming from the McIlwraith Range; we found it much larger than we expected, as it had twice as much water as Hays' Creek. We determined to move camp in this direction as soon as the weather permitted.

January 16.—It rained most of the night, and almost all day. Moving camp was out of the question.

January 17.—It rained most of the night and to-day, till it was too late to move camp. The flats which we had to cross were very boggy. It cleared a little at one time, and we saw the sun for the first time since the 11th. After dinner I accompanied Messrs. Crosbie and Layland to the creek we had visited yesterday. We tried some crevices among bars on the left bank near where the creek escapes from the hills, but got no gold. The bars are of highly micaceous gneiss, with some beds of micaceous greywacke, and some of Lydian stone. The beds are vertical, and strike north and south. The creek falls to the north-north-east. During our stay at Hays' Creek immense flocks of Torres Straits pigeons left the islands, and flew inland at daybreak; they flew pretty high, but we managed to shoot enough for the pot.

The night kept fair, and I even saw a star.

January 18.—Left Camp 25. After crossing some boggy flats, with tea-tree and grass-tree, we struck the creek visited yesterday (three miles) at a point which bore west 27 degrees south from the mountain on the north side of the "opening in the hills." Thereafter we kept a general course of north-north-west. In a mile, over grassy ridges, with scrubby gullies, we crossed obliquely a wide valley with two large third-magnitude creeks. In the last of these—Greyhound Creek—a horse of that name fell and wet a fifty-pound bag of flour; all that was wet was baked the same night, so that there was no loss. Near Greyhound Creek a gin and child were seen. We crossed next some high ridges of granite, affording a fine view of the Macrossan Range, but as it was getting late in the day we dropped down into the valley again, and camped on the left bank of a gully. A camp fire was seen about half a-mile back from our camp. We travelled about nine miles on a general north-north-west course. The day was fine till three o'clock, but very close and steamy. It rained from three till nine. [Camp 26.]

January 19.—Rain in the morning, and showers and drizzle till mid-day; warm and close for the rest of the day.

Before leaving Camp 26, Crosbie and I ascended a hill near the camp and took bearings, as follows:—

From N.W. end of Macrossan Range	S. 13 W.
„ Conical Island ("High Island"), in Lloyd Bay	S. 19½ W.
„ East end of headland ("Red Hills" in Admiralty Chart) south of Cape Weymouth	S. 5 W.
„ Camp 25, on Hays' Creek	N. 30 W.

From this hill we had a clear view of the whole course of the Lockhart River from its source near Hays' Creek to Lloyd Bay (about twenty-five miles), where it entered the mangroves, in which we could see large inlets. Captain Moresby tried to get up this river from the sea, but failed, as will be seen by the following extract from his work*:—

"Wishing

* "Discoveries and Surveys in New Guinea and the D'Entrecasteau Island, a Cruise in Polynesia, and Visits to the Pearl-shelling Stations in Torres Straits, of H.M.S. 'Basilisk.' By Captain John Moresby, R.N. London: John Murray, 1876."

"Wishing to clear up a doubt as to the existence or non-existence of a river reported at the bottom of Lloyd Bay, we stood in and anchored near Low Island on the evening of the 15th (January, 1872). The chart at this point is marked 'Apparent opening of a large river,'* and it will be seen by a glance at the map of North Queensland that a river would be a rich gift of nature here, as affording an opening into the country and a highway for the transit of agricultural produce. Navigating Lieutenant Connor and I, in the galley, and Mr. Mourilyan, in the gig, came to an anchor accordingly off the supposed entrance of the river at 11 p.m. At daybreak we began our search for the river, and explored one saltwater creek after another, but each was a failure, and led only to entanglement in the swamp, where clouds of mosquitoes resented our invasion of their holds. There was no river. The drainage of a hill range six or seven miles inland had created a swamp of many miles extent, covered by mangroves, and intersected by these saltwater creeks, and that was all."

On leaving Camp 26, we tried to get back to the western fall of the McIlwraith Range. We got west for about five miles, without interruption, by tolerably clear ridges, bounded by scrubby gullies. At the end of the five miles we had a view across the valley of Greyhound Creek, whose head bends round to the north-west. The creek has a deep rocky channel, and wide bamboo scrubs. We could see the divide before us, but could not cross the creek, and, after trying it in three places (carrying us about a mile to the south), we had to camp on the left bank. [Camp 27.]

This was a fine night, with struggling moonlight. The sky was quite clear for a short time. The ground had been so saturated with rain that, when I got into my hammock, one of the trees to which it was attached came out by the roots and fell over the tent. Crosby was still more unfortunate. He was driven out of one tent by ants, and a tree supporting his tent, when it had been re-pitched, came down with him.

January 20.—This was a fine day, with only one shower, though dull and cloudy. Crosbie, Hume, Layland, and Charlie went ahead for about eight miles, cutting a track through bamboo scrubs for about three miles. I occupied myself in constructing working maps from the charts, &c. The night was fine.

January 21.—A showery day. We left Camp 27 by the track cut yesterday. After crossing Greyhound Creek, we crossed a branch of it twice. For three miles the path led through bamboo jungle and scrub, in a general west-north-west direction. At the end of the three miles we got on a ridge forming the right wall of a valley, probably one of the heads of Greyhound Creek. We kept the ridge for three miles, winding with it first west, then round to south, then west again. At the head of this ridge we were practically on the divide, and a marked change took place both geologically and botanically. The trees were almost all she-oaks. Thick clumps of ferns *(Athyrium)* sometimes impeded our progress. The grass (*spinifex*) was very poor. The rock was a granular quartzite, with a good deal of reef-quartz scattered about.

We continued our journey for about five miles more across ridgy country, on a general north-west course, the gullies now falling to the west. We saw some outcrops of ferruginous mica-schist, with a good deal of red-tinged quartz. Layland and Hamil tried a gully below some quartziferous ridges, but got no gold. On the western fall of the range the grass gradually improved, and the she-oaks gave place to stringybarks, woolybutts, bloodwood, and apple-gum. We camped on a third-magnitude creek running south-west, which I named after Professor Hall, Director of the Geological Survey of Ireland. [Camp 28.]

We must have mounted about a thousand feet above the level of the sea, and yet we had evidently crossed one of the lowest gaps in the range.

January 22.—There was some rain in the night, but the day was fine, warm, and breezy, and we got our things well dried. The day was spent chiefly in horseshoeing and prospecting. The prospectors were up the creek for about three miles, where it has less fall and the valley is wider than at the camp. The country is of mica-schist, striking north and south, with numerous reefs of white granular quartz along the lines of bedding. No gold was obtained.

I crossed the creek, and went up a spur to a point on the hills bearing west 14 degrees north from the camp, and about two miles distant, and had a very extensive view. The sea was visible through four distinct gaps in the Macrossan range. The following bearings, among others, were taken:—

From the sea through the "opening in the hills" marked on coast chart (Hays Valley) ...	W. 2° N.
From north point of the hill marked "1,073" in coast chart ...	W. 20° S.
From Camp 25 on Hays Creek ...	W. 30° N.
From Camp 24 on Nisbet Creek ...	W. 42° N.
From Cape Weymouth ...	S. 7½° W.
From steep grassy S.W. end of a wooded hill, one mile off, with valley between ...	W. 15° N.
From end of left wall of Attack Valley ...	N. 30° E.
From View Hill, near camp 13 ...	N. 35° E.

The sandstone cliffs of the Geikie Range could be traced northward to west, 5 degrees north from the point of observation.

Hull Creek could be seen emerging from the hills about three miles to the south-west, and could be traced by a belt of scrub, bordered by open plains, to its junction with Geikie Creek about twenty-five miles W.S.W., four or five miles above the junction of the latter with the Peach.

On returning from the hill, I accompanied Mr. Crosbie down Hull Creek to see if there was a practicable way for the horses out of the valley. The valley was found to be extraordinarily steep and narrow, and there was evidently no passage that way. The creek falls about fifty feet a quarter of a mile below the camp, and then takes a sudden bend to the east. It was clear that we would have to go by the hill from which I had come.

January 23.—We left Camp 28 and ascended the spur to the point from which I made the observations yesterday. Thence we sidled down the hill (a descent of nearly 1,000 feet) to the south-west. We then crossed a fourth-magnitude creek and touched the south-west end of the wooded hill,

bearing

* More recent editions of the chart have "Dense mangrove swamps and saltwater creeks."

bearing west, 15 degrees north from the hill we had left. From this point we struck west. In half-a-mile we crossed a third or fourth magnitude creek. This and the creek last referred to join about two miles to the south, and fall into Hull Creek in one mile further.

At the foot of the hills the timber alters its character. The trees are chiefly stringybark, blood-wood, box, woolybut, and apple-gum, with Moreton Bay ash in alluvial flats.

We continued to the west for two and a-half miles up a gentle rise, well grassed, to a low divide, whence a view was obtained of the McIlwraith Range. Towards the top of the rise, stringybark and box timber prevail; there were also a few small ironbarks.

In two miles to west 10 degrees north, a granite hill was passed about two miles off to the left. Half-a-mile farther we passed close by a second granite hill on the left. One mile to the north-west of this mountain we camped on the left bank of a fourth-magnitude creek. [Camp 29. Latitude, by observations of Capella and Canopus, 13 degrees 11 minutes south].*

From the base of the range to the camp, the country traversed was of macro-crystalline reddish granite. No reef-quartz was seen.

January 24.—We struck due north for two miles over ridges of coarse reddish granite, decomposing to a soft soil, well grassed (no reef quartz). In two and a-half miles we crossed a third-magnitude creek running west 30 degrees south. On crossing it I ascended a hill on the right bank and took a series of bearings.

In one mile north 25 degrees east we crossed a spur of the hills on the right. From this point onward the granite was grey, and finer in grain than that which we had passed yesterday and to-day. Occasional outcrops of sandy ferruginous greywacke were seen. Where these occurred, there was generally a good deal of quartz.

We kept north for a mile and a-half along the edge of the hills. The prospectors tried several gullies here, but got no gold. A mile and a-half to the north, across a level valley (granite), we crossed a fourth-magnitude creek. In half-a-mile further, past a spur of the range on the right, we crossed a creek of the fourth magnitude, and camped on the right bank. The prospectors tried this creek, but got no gold. [Camp 30.]

In the afternoon I ascended the mountains north of the camp, and took the bearings of a number of known positions to the south. The whole of this range is of rocks which have not undergone extreme metamorphism. The commonest is a sandy mica-schist, and a coarsely-granular quartzite comes next. There are also some sandy slate-rocks and some greywacke. Quartz reefs are very numerous, but the quartz is not of a promising character. Tea-tree and she-oaks are the commonest trees on the ridges. The highest hills of the range (seen across a valley to the north) are almost bare of timber.

January 25.—Shoeing horses, &c. In the afternoon Crosbie and I ascended the bare hills north of the camp, and at a point three miles to the east had a view of Cape Weymouth, Lloyd Bay, and the Macrossan Range. We saw also to the north a wide, heathy flat (which afterwards proved to be the valley of the Pascoe) dividing the McIlwraith Range from a range to the north. Here we saw for the first time the Pitcher-plant (*Nepenthes Kennedya*), which afterwards became very familiar.

There was heavy rain in the afternoon and showers at night.

January 26.—A dull, showery day. We left Camp 30 and after skirting the range for three miles west, crossed a third-magnitude creek running south-west. In half-a-mile more we recrossed the same creek, here running north-north-east, and a good deal larger than at the upper crossing, having probably received the creek we left in the morning. In half-a-mile to the north-west, on a grassy plot with Moreton Bay ash and box timber, we came on tent-poles and ridges for eight tents, more than one season old, supposed to be the camp of Sefton and his party when they left the Coen rush in April, 1878. Here we crossed the creek again. It flows through a gap in green hills to the west. I named it Sefton Creek. From subsequent correspondence with Mr. Sefton, Mr. Crosbie ascertained that the former believed it to join the river to the south (the Peach).

We ran to the north for three miles up a valley in gently undulating, well-grassed country, lightly timbered with white gum, Moreton Bay ash, and box. A small watercourse, a tributary of Sefton Creek, lay to the left of our course. A range of green hills, with alternate scrubby and bare patches, formed the right or western wall of the valley. The bottom of the valley was of grey granite.

At the head of the valley we crossed a low divide (ferruginous greywacke and mica-schist, with much white quartz), with grass-tree (*Zanthoria*), stringybark, and bloodwood.

We continued our course to the north through granite country similar to that on the south side of the divide, but rather more closely timbered. A large native camp, which had been deserted for about a fortnight, was passed. At the end of the four miles I got on a granite "tor," and saw clear, low country for a long distance towards Cape Weymouth.

We struck out in the direction of the Cape (north-east), as I had arranged, through the kindness of Mr. B. Fahey, Sub-Collector at Cooktown, to call there and leave letters to be picked up by the Customs cutter on her way to the lighthouses between Torres Straits and Cooktown. In a mile and a half, through very poor country, we came to a fourth-magnitude creek flowing to the north-north-east (a tributary of the Pascoe) in deep soil with very steep and treacherous banks. There was only one possible crossing. The horse I rode ("Poodle") stumbled and fell, and I had to jump off into a deep pool. The saddle-pouch, in which I carried my maps, note-book, &c., was filled with water. We camped on the right bank. [Camp 31.] This camp was a very poor one for the horses; spinifex grass, myall wood, and tea-tree. There were showers during the night.

January 27.—One of Crosbie's horses had got poisoned overnight, and when found in the morning was streaming with perspiration and staggering. It managed to do the day's journey, however, but was very ill at night—cold and unable to stand.

This was a dull, threatening day, with one very heavy shower. We travelled for a mile and a-half to north 33 degrees east over level country with a bottom of fine, white sand, with heath and stunted bushes.

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* For some time back it had been impossible to fix the latitude, as we rarely saw either sun or stars. This was, however, at the time not of much consequence, as we were near the coast, and could make out our position by compass bearings.

In one mile and a-half more to north 33 degrees east, through dense brushwood scrub, we crossed from the left to the right bank of a deep third-magnitude creek, running north-west. The fine, white, sandy bottom extended to here. For the rest of the day we traversed gently undulating country (rising on the whole), with a granitic soil.

Five miles further we crossed a gully, running to the west, with vine and bamboo scrub. In a mile and a-half more we crossed a similar gully and camped. [Camp 32.]

After we had camped, I crossed another scrubby gully and ascended the hills to the north. The hills were of granite, weathering so as to show in relief large crystals of orthoclase felspar, quartz in round grains, and black mica. A good deal of reef-quartz was lying about. The tops of the hills were scrubby, and I could only get a view in glimpses from some of the barer spurs. The northmost peak in the Macrossan Range bore east 28 degrees south; Cape Direction east 2 degrees north; and the south end of High Island in Lloyd Bay east 30 degrees north. I touched a stinging-tree with one finger of the left hand in pushing through the scrub. The pain mounted in about twenty minutes to the armpit, and I had intense pain for three days and could not sleep at night.

Another of the prospectors' horses took violently ill at this camp, with every symptom of poisoning.

January 28.—Heavy rain began about 3 in the morning, and continued to fall till midday. The sky cleared somewhat in the afternoon, and I accompanied Messrs. Crosbie, Hume, and Leeland to the divide, which lay about two miles to the east of our camp. At one point we could see High Island, and the sea looked only four or five miles distant. The western slope, up to the very divide, is easy and lightly timbered (chiefly with oaks), but the eastern slope is a steep escarpment clothed with dense scrub. We skirted the escarpment for about two miles to the south, and tried to get down in several places, but could neither see nor get down. We also ran it north till it abutted against the range north of our camp, which is densely scrubby, except on the spur by which I ascended yesterday. With one consent we abandoned the attempt to reach Cape Weymouth, which could only have been done at a ruinous expense of horse flesh.

The night was fine, but too cloudy for observations of the stars.

January 29.—One of the prospectors' horses being still too weak to travel, we did not move the camp. Crosbie, Hume, and I visited the hills to the north-west, to see what sort of "get-away" there might be in that direction. (Granite country, with some reefs of white quartz, with long interlacing dog-tooth crystals.) We found ourselves looking into the valley of a large stream running from north to south. On crossing to this stream we found it to be a deep and rapid third-magnitude creek, with a fringe of bamboo, palm, and vine scrub. The creek, which we afterwards knew as the main head of the Pascoe River, takes its rise in a range of rugged mountains which occupy the space from Weymouth Bay to the south end of Lloyd Bay. This mountain mass I named the Janet, after my wife.

The creek was flooded, and where we struck it was too deep for the pack-bags to be carried across by the horses without injury to their contents. We had made up our minds to unload, and carry the packs and saddles across on our heads, but we afterwards found a shallower crossing, to which we cut a track through the scrub. We also blazed a way back to the camp (east 15 degrees north, three miles).

On our return the horse which last took ill was found dead. The stomach and bowels were found to be much inflamed, the former containing grassy pulp mixed with blood.

Macdonald prospected in the creek at the camp, but got no gold.

January 30.—On leaving Camp 32 the horse which had been poisoned at the previous camp seemed in a dying condition, but it was driven on, on the chance that it might recover. It was quite crazed, its jaws firmly locked, with the mouth askew, and its tongue swelled so that it could eat nothing. It recovered, but was of no use for the rest of the journey.

When we reached the creek to which we had cut a track yesterday, the flood had abated considerably, but the crossing was still a matter of some difficulty.

Two miles to the south-west, through stony granite country (without quartz reefs), we crossed the heads of some gullies, which flow to the north-east to join the creek we had crossed. Three miles further to the west we camped (on the site of a native encampment) in good grassy country, by the left bank of a gully falling to the west.

The day was fine, with only one shower. The night was fine, but cloudy. [Camp 33. Latitude, by observation of Canopus, 12 degrees 55 minutes south.]

January 31.—Leaving Camp 33, we travelled westward over granite ridges, with large boulders (no quartz reefs). High granite hills lay to the right about two miles distant. In a mile and a-half we crossed a large fourth-magnitude creek, running south-south-west, with a very rocky (granite) bottom.

Two and a-half miles further to the west, towards what appeared to be an opening for the stream in the valley to the low country in the west, we came unexpectedly on the right bank of the stream, which had now become a creek of the first magnitude, or almost a river, and was in high flood, and running swiftly over a rocky bed of granite, and quite impassable. We were in doubt as to whether this creek flowed into the Pacific or the Gulf, and as that question would have to be settled before we could determine whether or not we should cross (which would have been difficult and dangerous) we struck north.

In a mile and a-half we were on a granite hill, on the right wall of the valley, and enjoyed a magnificent view. The river was seen for some miles of its course, tumbling to the north-north-west with many waterfalls. The bottom was either bare granite or choked with tea-trees. On both banks the higher granite hills were capped by outlines of the horizontal sandstone which covered the whole of the country to the west. The granite range to the east rises to much greater altitudes than the sandstone, and must have been dry land when the latter was deposited.

In two and a-half miles to the north we crossed two forks of a rocky fourth-magnitude creek running to the south-south-west. In a mile and a-half more we recrossed the western fork and camped. [Camp 34.]

The day was fine, with only two showers.

February 1.—Dull, heavy. Rain, most of the time we were travelling added to the discomforts of an otherwise troublesome enough day.

We travelled north-north-east for two miles over very rough, stony, granite hills, most of the time ascending, till we found a third-magnitude creek in a narrow gorge, tumbling impetuously to the west and

and quite impassable. The creek seemed to rise among the highest summits of the Janet Range, and these looked too formidable. We turned, and made for the low country down the valley, of which we could sometimes catch a glimpse to the north-west.

In a mile and a-half to the west, along the crown of the left wall of the valley—descending for about 1,000 feet—over very rocky (granite) and partly scrubby country, we came down into the valley, near the mouth of a fourth-magnitude creek coming from the south, and draining a very deep valley. After much search (Crosbie and Layland swimming) we found a passable crossing of the third magnitude creek, about a quarter of a mile below the mouth of the tributary.

Half-a-mile to the north-west we cleared a mountain of gneissose granite, which terminated the right wall of the constricted part of the valley, and the country lay before us, pretty open to the north. In one mile to the north we camped on the right bank of the creek, which was afterwards named Canoe Creek. [Camp 35. Latitude by observation of Canopus, 12 degrees 49 minutes 30 seconds south.]

After we had camped, I went on to the hills forming the right wall of the valley, about a mile to the north of the camp, and saw clear open country to north 10 degrees west down the valley. Cliffs of horizontal sandstone were seen to the west, stretching in ever-receding promontories to the south-west towards the Geikie Range, with which they are probably connected. Down the valley of Canoe Creek was a long stretch of low heathy country. In about five miles the valley was joined by another extending east and west, but I was unable to make out whether it had its outlet to the south-east or north-west, the promontories of Janet's Range shutting out the view.

Rain most of the night.

February 2.—A wet day, and every sign of a week's rain. Considering this prospect, the flooded state of the creeks, and the boggy nature of the country ahead, and, moreover, that one of the prospectors' horses was too lame to travel, having been staked in the knee the day we passed Sefton Creek, we busied ourselves in making ourselves as comfortable as we could in wet-season quarters. Crosbie's party put up a bark shed to keep their fire in. We put up an old fly for the fire, and a fly with a table and seats for meals and drawing.

Hume and Hamil, prospecting in beaches on the creek, could get no gold.

Crosbie and I crossed the creek by a tea-tree, which we were fortunate enough to find bridging it, and made for a hill on its left bank about two miles down, whence we hoped to get a view to the north-east. We were disappointed, for we had barely reached the foot of the hill when rain and fog suddenly obscured everything, and we had to return to the camp. The country on the left bank of Canoe Creek was composed of sandstone and conglomerate cement, affording fairly sound travelling, but covered with heath and brushwood scrub, through which horses could only be driven with much difficulty.

Rain all night.

February 3.—Heavy rain in the morning. The rest of the day dull and showery. Drizzling all night.

I went out towards the hill we attempted to visit yesterday, but found the tea-tree bridging the creek at least four feet under water.

February 4.—There was not much rain to-day. In the afternoon Crosbie, Hume, and I went to the hill on the left bank, the tea-tree bridge being again practicable. We saw Canoe Creek going north for five or six miles from the hill. A sandstone table-land lay to the west and north-west, and there was outlier of sandstone on the right side of the valley. High granite mountains (Janet Range) to the east. The valley was a barren heathy flat, and apparently had its outlet to the north-east.

February 5.—Macdonald and I crossed Canoe Creek, where we had crossed with the horses on 31st January, and found the water only about six inches higher than on that occasion. My intention was to penetrate to the west for some distance, and see what had become of the river we had left on the 30th. We had hardly got half-a-mile from Canoe Creek when a perfect deluge of rain began. After waiting for some time we had to return to the camp, as there was no sign of improvement; the ground was becoming boggy and the ford would soon be impassable. The rain continued all day, and got very heavy again at nightfall. In the afternoon the creek was as high as it had been since we camped here. The ground was now so soft that it would take three or four dry days before it could be fit for horses.

February 6.—A fine day, occasionally cloudy. The sun very warm.

I went out over the hilltops, east of the camp (fine-grained granite), and made out that the river between camps 33 and 34 must breach the sandstone range not further north than a gap which lay about twelve miles off to south 15 degrees west.

To the west the country is for the most part sandstone table-land, sloping almost insensibly to the west, but presenting steep escarpments, which mark the outcrop of thick beds, to the east. The edge of a high table-land (which I named the Wilkinson Range, in honour of the Government Geologist for New South Wales), about twenty-five miles off, subtended an angle of from west 10 degrees north to west 10 degrees south. The eastern escarpment of this range must lie about 142 degrees 33 mnutes E. longitude, and twelve or fifteen miles east of Messrs. Jardine's route northward in 1865; although the Messrs. Jardine saw nothing approaching the character of a hill till forty miles further north. This is easily explained by the fact that they kept on the western slope of the range, which corresponds with the almost insensible dip of the strata.

I could see lower sandstone country, dead flat or apparently so, to the north and south of the Wilkinson Range for about fifteen miles.

Down the valley of Canoe Creek two mountains were seen in a line due north, one about six and the other fifteen miles off. Immediately to the north of the former the ground falls away to the east, and the creek must go that way, as there is no other possible outlet for it.

Between the north-west of the two hills and the eastern end of a high, rough sandstone escarpment about three miles further off, and bearing north 7 degrees west, is flat, low sandstone country, extending eastward to the base of the mountains at Fair Cape.

The night was threatening, but there was no rain.

February 7.—This was a fine warm day. The flood having fallen considerably, we left Camp 35 and crossed to the left bank of Canoe Creek and continued our course down the valley to the north. In three miles of travelling we passed the hill to which we had advanced on the 4th. In a mile and a-half more, over dead, flat sandy country timbered with bloodwood, stringybark, and pandanus, we reached a fourth-magnitude creek running east into Canoe Creek. Here one of my old packhorses ("Jimmy"), which had

had previously bogged in a gully and had to be unpacked, tumbled back from the bank into the creek and filled the bags containing my books, maps, instruments, and clothes with water. A spur of the sandstone-capped range on the west comes down to Canoe Creek here. (Gneiss, porphyry, and slate, with much quartz; the strike of the slates N.E. and S.W.) The prospectors tried some gullies, but got no gold.

In half-a-mile "Jimmy" tripped over a sapling and tumbled over and over into a gully. We unpacked him for the third time, and did all we could to raise him. We got him on his fore legs twice, but he seemed incapable of standing on his hind legs. We had to leave him and put his packs on another horse.

In two miles more to the north, over scrubby and heathy cement country, we again touched the left bank of Canoe Creek. Here coarse, white gritty sandstone was seen, resting horizontally on vertical conglomeratit slates, which have a north-east and south-west strike. On the right bank was a cliff fifty or sixty feet high of thin-bedded reddish horizontal sandstones.

We followed the course of the creek for two miles to the north-west till we found it falling into a broad, deep, rapid flooded river coming from the west. This must be the same river which had already puzzled us so much. There can now be no doubt that it is the river falling into Weymouth Bay named the Pascoe by the unfortunate Kennedy.

We camped on the point between the Pascoe and Canoe Creek. [Camp 36. Latitude by observation of Canopus, 12° 14′ S.]

February 8.—Macdonald, Charlie, and I went back with a draught horse to do what we could for "Jimmy." We found him alive and groaning. He had struggled about his own length up the gully. We laboured with levers and the draught horse for an hour or more, but could not get him to his feet. We then shot him. He was an old friend, and "I could have better spared a better horse." We cut off his shoes and took away about 80 lbs. of meat, the last of our beef having been boiled in the morning and game having become very scarce. All hands were busy till nightfall cutting up and curing the meat—mostly with pepper, for we had not much salt. We enjoyed the luxury of fresh meat. The "steaks" tasted well, but were dreadfully tough.

The prospectors had found a hollow tree, and were busy making a boat of it, splitting rails for the ends, &c.; Crosbie had been looking out for a crossing for the horses up the river, but found none practicable.

February 9.—In the morning I pasted and touched up the maps damaged by water on the 6th. The day was very warm, with only one shower in the afternoon. In the afternoon I measured the river (trigonometrically), and found it seventy yards wide. The horseflesh was drying in the sun. Crosbie and Charlie crossed Canoe Creek, and went down the Pascoe for some miles to the north-east.

The boat was launched in the afternoon, but was found to leak a good deal.

February 10.—The boat on her trial trip got somewhat injured, and it took till dinner time to calk her with clay, and cover her with canvas pack-covers. It was then launched, and Crosbie, Layland, and Hamil crossed the river to cut the scrub at the landing. Hume and I went up the river to look for a crossing, being of one mind in caring little for boating. I stripped and tried for fords in several places, but was carried off my feet every time. At last I ran a near chance of drowning, being thoroughly exhausted before regaining the bank above a reach of dangerous rapids. We gave up the attempt, and reconciled ourselves to the boat.

After dinner we got the horses across Canoe Creek, which was fordable, and swum them across the Pascoe. Macdonald and Charlie rode across on "Brownie" and "Moonlight." It was very hard to get some of the horses to face Canoe Creek, "Coen" and "Greyhound" getting quite mad and breaking away into the bush. All swam the river in gallant style.

The river began to rise while we were getting the horses across, and had risen six inches before we had done. It fell again seven inches before nightfall.

A few heavy showers fell in the night, but did not last long enough to raise the river.

February 11.—The great work of getting our loads across the river was accomplished to-day. We carried the prospectors' things down, and in return Crosbie and Hamil ferried ourselves and our baggage across. The river and creek were rising steadily all the time, and had risen three feet by two o'clock, when the last of our things were landed. The ferrying of the last two boatloads was a very severe struggle, the force of the current having increased very much with the rise in the water. Carrying the loads down (about 150 yards) and packing them up the bank on the north side was hard work, the day being very sultry. In the afternoon thunder clouds gathered and a few light showers fell.

We camped on the left bank of the Pascoe. [Camp 37.]

Our camp was probably about fifteen miles higher up the river than the place where the unfortunate explorer Kennedy left the remainder of his party when he set out on foot, accompanied only by his black-boy, Jacky Jacky, to meet his fate at the Escape River, within sight of the ship which was to bring him relief. The hills at Fair Cape were doubtless the last objects that met the eyes of his companions, as one by one they sickened and died while waiting for the relief which was to come too late for all but two of their number. Up the left bank of the river for about two miles the country is of the poorest imaginable description. It is a "cement" of decomposed sandstone, intersected by gullies, and clothed with heath and small brushwood. There is not a blade of grass.

My hands are in a pitiful condition, being lacerated by the scrub, which seems to be capable of blood-poisoning. They are so painful that I can hardly sleep at nights, and the flies torment me in the daytime.

February 12.—This was a very warm day. We were prepared to make a start, but five of the horses were missing, and were not found till the afternoon. They had left our camp, where the only grass was, and strayed into wretched brushwood country. One of the prospectors' horses had got staked in the knee, and had to be operated on. There was one shower in the afternoon; the night was fine.

February 13.—Left Camp 37, and in one mile to the north-north-east ("cement" and heath) reached the edge of a high sandstone table-land. For the next five miles to the north we kept on the edge of the table-land, looking down into the valley of the Pascoe, with the Janet Range beyond. The sandstone table-land (to which I gave the name of the Sir William Thompson Range) had a red soil, and was timbered with stringybark, bloodwood, zanthoria, and pandanus. This table-land extends from the valley

valley of the Pascoe in longitude 143 degrees 3 minutes east, and latitude 12 degrees 40 minutes south north-north-eastward to the 12th parallel, and presents a steep escarpment to the Pacific and a long gradual slope towards the Gulf.

At the end of the five miles we descended about five hundred feet from the table-land (half-a-mile east) to a lower shelf of sandstone. The strata on the table-land are reddish and cemented with iron. The beds on the lower shelf are yellow and white—all gritty and some containing a few pebbles.

In a mile east-north-east we reached a fourth-magnitude creek in a deep valley. We ran it up for half-a-mile west-north-west, and crossed. In half-a-mile more to the north, across a heathy ridge, we crossed another branch of the same creek.

In a mile and a-half to the north, across the chord of a bay in the Sir William Thompson Range, we camped on a gully near a promontory of the range. The vegetation was similar to that on the top of the table-land, with the addition of a few ironbarks and myallwood trees. [Camp 38.] There was a thunder-storm at night and no observation was possible.

February 14.—A sultry, oppressive day. We travelled two miles to the north, over open sandstone country timbered with stringybark, bloodwood, grass-tree, and pandanus, sloping to the east—the cliffs of the Sir William Thompson Range visible about a mile to the west.

Our course next lay north 10 degrees east down the right wall of the deep valley of a fourth-magnitude creek. There was flat sandstone country on both sides of the creek, occasionally open, but for the most part covered with heath. On the creek, turning nearly due east, we crossed to the left bank. It was running briskly.

Half-a-mile more on the same course, across burnt heath, we crossed another fourth-magnitude creek. The two creeks joined about a mile down and fall into the Pascoe.

A mile and a-half to the north, through strong heath, we reached a gully in cement. One of the old pack-horses ("Queensland") got bogged in the gully and had fairly to be dug out with spades. We came back to the right bank (heading the gully this time), and ran the gully down for a mile to the south-south-east to its junction with a deep and rapid creek of a third magnitude. Having found a practicable crossing of the latter, we camped on the right bank. [Camp 39. Latitude, by observation of Canopus, 12 degrees 34 minutes S.]

February 15.—This was a sultry day. Leaving Camp 39, we touched in a mile and a-half to the north some low hills of porphyry and hardened slate, from which the sandstone had been denuded. Here we had a view (to the north-east) of the serrated mountains between the mouth of the Pascoe and Temple Bay, which I named the Carron Range, in commemoration of the tragic circumstances connected with Dr. Carron's stay, when Kennedy left him on his last forlorn expedition.

The timber on the porphyry and slate differed in character from that on the sandstone. Moreton Bay ash, ironbark, and white gum took the place of stringybark, bloodwood, grass-tree, and pandanus.

In half-a-mile more to the north a boggy flat was crossed, and the sandstone recommenced, at a lower level than the porphyry, and also (in hills on the left) at a higher, showing that the appearance of the porphyry and slates was the result of denudation.

A mile and a-half further (heath and brushwood) the bottom of the sandstone again appeared, this time resting on granite. Two miles from the granite we crossed a heathy swamp. In two and a-half miles further, through heathy country, we came on a flooded creek of the fourth magnitude, draining the western side of the Carron Range. After running this creek down for two miles to the north we crossed to its right bank, and altered our course to north 15 degrees east, to strike the south-west angle of Temple Bay, having made arrangements through Mr. Fahey to communicate from the "remarkable red cliffs" with the keeper of the Piper Island lightship.

After four miles of white sandy soil, with stringybark, applegum, bloodwood, giant-tree, and pandanus, we reached a sandstone escarpment facing east, and made a descent of about 200 feet over edges of horizontal strata of gritty and pebbly sandstone. We camped in a fine grassy bottom among gigantic ironbark trees. Several emus were seen, but we failed to shoot any. [Camp 40. Latitude, by observation of Canopus, 12 degrees 23 minutes.] From a hill behind the camp which Crosbie and I ascended, we saw the Piper Island lightship, bearing east 38 degrees north; Haggerstone Island, bearing north 33 degrees east; and Bolt Head, bearing north 8 degrees east.

February 16.—Leaving Camp 40 we ran down the right bank of the gully for one mile (north 15 degrees east) and crossed. For the rest of the day we kept nearly parallel to the coast line, which here bends north and south. On the left bank of the gully we crossed a porphyry spur of the sandstone-capped hills, and had a view of the Piper, Forbes, Quoin, and Haggerstone Islands, and Cape Grenville. A mile and a-half from the gully (by the edge of a low sandstone rise, fairly well grassed) we crossed a fourth-magnitude creek, flanked by chains of lagoons (probably the creek we crossed yesterday). On its banks were heaps of sea-shells, and extensive remains of old native camps.

In three miles more, partly on the edge of coast-flats (sandy, with tea-tree and sandalwood scrub, &c.), and partly on the edge of the sandstone rise (red-soil country, well grassed), we camped on the right bank of an insignificant gully. [Camp 41.]

From a point near this camp the lightship bore east 27 degrees north.

After we had settled the camp Crosbie and I went ahead to see whether it was possible to reach the "remarkable red cliff" by the coast.

In one mile, by low sandhills, we crossed the mouth of a fourth-magnitude creek. North of the creek was a low promontory of brown sandstone, ten feet high, under twenty feet of red cement.

In a mile and a-half of low sandhills we crossed the mouth of a third or fourth magnitude creek, with some native huts constructed of bark on forks. One of them had two sheets of copper sheathing on its roof.

A mile and a-half further, with low sandhills to the left, we reached a bare headland of horizontal sandstone, resting on serpentine, about one hundred feet in height. On rounding the headland we found the wreck of a large copper-sheathed brig, with its cargo of cedar logs strewn along the beach. Most of the logs were branded L and some DH. As the crew of the lightship had never heard of the wreck, we imagined that it must have taken place before the lightship was anchored in its present position, which commands a view of the whole bay. On our return to Cooktown we reported the wreck, and Mr. Fahey visited

visited it, and identified the ship as the "Kate Connelly" which left Cairns for Sydney in March, 1878, and was never heard of again. The memorable storm of the 8th of that month, when Cairns was partly destroyed, sufficiently accounted for the disappearance of the vessel, but its fate remained a mystery till we accidentally discovered the wreck. The captain, it is believed, intended to go outside the Barrier Reef by the Trinity Opening. The ship was probably drifted in dark weather (otherwise it must have been seen from the lightship) to its last resting-place. The crew (7 or 8 in number) in all probability perished at sea. Had they landed in Temple Bay they must have met a horrible fate at the hands of the blacks. We saw no trace of the habitations of white men.

Half-a-mile beyond the wreck we reached Bolt Head, a bare promontory, which presents a cliff of about a hundred feet in height to the sea for half-a-mile. At the top of the cliff were about thirty feet of horizontal reddish sandstone resting unconformably on a blue limestone with a quasi-schistose structure. The limestone was at least one hundred feet in thickness, and had a dip to the east at 45 degrees.

For the next mile, through well-grassed country, partly scrubby, we saw numerous hoop pines. Then we crossed the mouths of two creeks of the fourth magnitude, and reached a bald red cliff of sandstone. This we ascended, and saw the "remarkable red cliff," still about a mile and a-half ahead, but quite accessible. We made a smoke on the headland to apprise the master of the lightship that we were in the neighbourhood. We returned to the camp at nightfall and found Macdonald again ill with fever.

February 17.—Macdonald was still very ill. We left Camp 41, and travelled north by the route described under yesterday's date. Just as we arrived at the point where we had turned back yesterday, the prospectors, who were about half-a-mile ahead, saw and gave chase to some "niggers." When I got up I found that they had rounded up two gins and some children. The gins had wavy, but not curly, hair. They dropped a three-pronged fishing spear, barbed with sail needles, and a fighting or hunting spear with a bone barb.

In a mile and a half more we reached the "remarkable red cliff," and camped above it on a bald rise, having a patch of scrub on the edge of the cliff and more scrub behind. Firewood and wate had to be carried a long way, but we wished to camp where our tents would be visible from the ship when lighted up by the morning sun.

Four or five blacks made their appearance after we had camped, and held up something white in their hands; but they vanished on seeing Hume pick up his rifle.

It appears that the men on the ship saw our tents as soon as they were pitched, but of course we did not know this. When night fell we made a big fire on the top of the cliff. In less than an hour we were answered by a rocket from the lightship.

February 18.—This was a warm day with a few thunder-showers.

At daybreak we saw a boat making for us. The master of the lightship (Mr. Tyrell) and two men reached the bay below our camp at half-past seven. As only one man was left in the ship they could only stay till half-past ten. They brought us twelve pounds of tinned beef and a pile of newspapers and some letters—both very acceptable. They had never been ashore, it appeared. They informed us that the blacks had speared a man in his ship in the bay. I sent off a short "Preliminary Report" to you.

In the afternoon seven blacks came up and parleyed outside the camp. Two acted as spokesmen, while the rest stayed behind. They spoke English, at least as well as the average Cleveland Bay blacks. They had wavy, but not curly, hair. They brought a bit of turtle-shell and a silver bream. Charlie gave them a bit of his tobacco, with the use of which they seemed familiar. They offered to exchange fish for tobacco, and we gladly accepted the offer, but warned them to come without their spears and only two at a time. They spoke of being familiar with the *beche-de-mer* fishers.

February 19.—Shoeing horses, &c. The horses did well at this camp, as there was plenty of good short grass and few flies.

I found in the cliff below the camp two coal-seams, each a quarter of an inch in thickness in grey argillaceous sandstone, overlaid by conglomerate with fragments of carbonised wood.

The day was sultry, with thunder-showers in the afternoon.

February 20.—We left Camp 42 in the morning, and, after travelling for a mile to the west, crossed from the left to the right bank of the creek which falls into the sea south of the "remarkable red cliff." The banks of the creek were boggy. Some hoop pines were observed in the scrub.

Two miles further to the west we re-crossed the creek. The intervening country was sandy, with tea-tree and stringybark and occasional patches of garrawan scrub and heath.

Shortly afterwards we got on a hard sandy ridge, and had a glimpse of the coast sandhills.

After two miles more of travelling to the north-west, we crossed a boggy gully, where some of the horses got stuck. Just before reaching this bog we observed a place where a recent hurricane had rooted up or broken down all the trees, clearing a lane about two chains in width. The course of the storm had been from south to north.

One mile and a-half more to the west, mostly through low open heath, we had a view of a remarkable conical sandstone-capped mountain, about six miles off to the south-west.

In one mile more, to the north-west, we camped at the head of a heathy and boggy flat. [Camp 43.]

About an hour before we reached the camp there was a thunderstorm, with ten minutes of heavy rain, which pelted us like hail.

February 21.—We left Camp 43, and, after crossing the bog, kept for half-a-mile to west-south-west on the south side of a lily lagoon, which proved to be the larger and outer of two anabranches of a large river here running to the north-north-east. As it was impossible to cross the lagoon, which was about thirty yards wide, not to speak of the river, we retraced our steps and started afresh from half-a-mile south of the camp.

We travelled from this point for a mile to west-south-west across low open bog, and for a mile and a-half to east-south-east, and half-a-mile to the south, along the edge of a narrow marsh choked with pandanus and pitcher-plant, when we crossed a fourth-magnitude creek which falls into the head of the marsh.

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In one mile west-north-west across low heathy country, partly sandy and partly boggy, we touched a chain of deep lagoons, and skirted them for half-a-mile to the south-west, when we crossed the stream connecting two of the lagoons (here running due east, and about equal in volume to a creek of the fourth magnitude).

In one mile further to west-north-west, over sandy country with she-oaks and stringybarks, we again reached the river which had turned us back in the morning. On running it up for a mile to the south some sandstone country was seen for the first time in the day's journey, and a creek of the second magnitude fell into the right bank of the river. We ran the former for half-a-mile to the east, when a fourth-magnitude creek branched off from it. The country here was low and liable to be flooded. A thunderstorm was impending, and the afternoon was far spent, so that we judged it better to return to the higher ground below the mouth of the fourth-magnitude creek and camp for the night.

Camp 44.—There was a thunder-shower after nightfall.

February 22.—The creek rose eighteen inches during the night, and fell six inches to-day. The day was very warm. Crosbie, Hamil, and Macdonald were engaged in building a dug-out for crossing the river below the mouth of the second-magnitude creek. I walked up the latter for three miles in the hope of finding a crossing, but was unsuccessful. Where I left the creek it bifurcated.

Layland had felled a tree for a bridge across the second-magnitude creek below our camp. On my return he and I crossed by the tree and traversed the low country to the river. On running the river up for a mile we felled a tree across it, but it was submerged for about nine inches in the middle, and would only be available for a bridge if the river should fall to that extent.

The boat on being launched in the afternoon was found to be too small and unstable for the strong current of the river, and another was commenced; the two to be lashed together.

There was no rain to-day, or in the night.

February 23.—The river had fallen only two inches in the night.

The double boat was finished by eleven o'clock and found to have a high carrying capacity, so no time was lost in getting the luggage across the river, and we camped on the left bank. [Camp 45.]

Getting the horses across proved a difficult and dangerous task. There was only one place moderately clear of scrub and snags, about a quarter of a mile above the "ferry," where it was possible for the horses to swim the river. There was first a long swim from the right bank to a sandy island near the left bank, but the current was strong, and if the horses got carried by it among the trees below there was little hope for them. From the upper end of the island a sandspit connected the island with the left bank, with only a few feet of swimming, but the bank was boggy.

The prospectors' horses crossed first. All of them reached the island safely except one young horse, "Monkey," which got carried down against a tree and struggled there till it was exhausted. On being freed at lastit struck back for the right bank, but was caught by the current and drowned before our eyes without our being able to do anything to save it. Then the prospectors' horses rushed into the channel on the other side of the island before they could be prevented, and as it was deep and strong, and the bank high and soft, they had a very hard struggle to land; but they all did.

When the time for crossing with my horses arrived, we manned the dangerous trees in the river, and by shouts and gesticulations managed to keep the horses clear of them, except "Moonlight," who was caught on the same tree that did for "Monkey," but Crosbie managed to push his head under it. He was swept below, and with a desperate struggle gained the island.

Considering the strength of the narrow channel between the island and the left bank, and the boggy state of the bank, I made Charlie lead the horses one by one along the shallow spit, then the halters were handed to a man on the bank and the real difficulty with the boggy bank began. "Queensland," "Greyhound," "Rose," and "Greenhide" had literally to be dug out and hauled up the bank by main force. I was much indebted to Crosby and his party for the service they rendered here, without which, we should certainly have lost some of the horses.

At our last camp the flies "blowed" everything which had any perspiration on it. Our blankets and stockings were covered with maggots. At Camp 45, which was in floodable country, the ground was alive with caterpillars.

The night was cloudy and threatening, but no rain fell.

This large river (which was named the Macmillan, after Mr. A. C. Macmillan, late Engineer of Roads for Northern Queensland), when we first saw it, was pursuing a course to the north-north-west, among low heathy flats. Whether it falls in Temple Bay, Margaret Bay, or Shelburne Bay, I had no means of judging. It had, when we saw it, a volume of water about equal to that of the Clyde at Glasgow, but was evidently in flood. As its general course was to the north-east while we followed it up, we concluded that it took its rise far to the south-west, and therefore determined to cross it. When, however, we reached higher ground on the following day we found that the river really took its rise far to the north-west, and followed closely the base of the escarpment of the Sir William Thompson Range to within a few miles of where we crossed it. Had we kept the left bank for a few miles further than we did we could have rounded the elbow of the river and got away easily to the north-north-west.

February 24.—On leaving Camp 45, thankful to escape being flooded out (which must have happened had any large quantity of rain fallen during the night), we kept for half-a-mile to the west on an alluvial flat of the Macmillan. After three-quarters of a mile to west-north-west through sandy country timbered with stringybark and tea-trees with occasional clumps of brushwood, we passed a lagoon on the left.

In a quarter of a mile to the north-west we crossed the head of a bog. For the next quarter of a mile (west) we kept between a bog on the left and a scrub on the right. The bog was choked with pitcher-plant and a species of marestail.

After three-quarters of a mile to the north-west, through very dense tea-tree scrub (which had to be cut), we emerged in a pitcher-plant bog skirting a gully falling to the south-east.

For one mile further to north-west, and half-a-mile to west-north-west, between a scrub (on the left) and a bog, we crossed the head of the latter and had a view of the Sir William Thompson Range. A lower sandstone escarpment was seen to the left about a mile distant.

The

The next three-quarters of a mile to the north-west were through dense scrub, which had partly to be cut. To this succeeded a mile of open forest country leading up to sandy spurs of the low range.

We camped on the small gully. There was a difficulty in finding water, but a heavy rain began as we came into camp, and by the time our tents were pitched we could catch enough for all our needs from the calico. Love had great difficulty in lighting a fire in an anthill. [Camp 46.]

February 25.—There was heavy rain in the morning, and we did not move camp, but employed the time in horse-shoeing and other odd jobs. The last of my shoe nails were used to-day.

The day cleared about noon, but there were some very heavy showers towards evening.

I ascended the sandstone range by a spur behind the camp, and went along the edge of the table-land for about a mile to a bald hill, from which a good view was obtained. Forbes Island lay east 15 degrees south. The sand-hills were visible as far north as north-east. The Macmillan River appeared to be carried north from Camp 43 by the sand-hills and sandstone bluffs of the coast, through heathy and boggy flats.

The night was dull, with several showers.

February 26.—There was rain at sunrise, but the weather cleared before midday. We left Camp 46, and continued our journey towards Cape York.

For a mile and a-half to the north-west we kept close to the edge of the low sandstone table-land till we reached the hill from which I had taken bearings yesterday. For the same distance to north-north-west we were still near the edge of the table-land, and headed a number of gullies which fell away to the west, probably into the Macmillan River. Then we ran a creek down from its head, north-north-west, three-quarters of a mile, north-west one mile, till it left our course going westward to join the Macmillan. In two miles more to north-north-west we reached the northern escarpment of the table-land, and after taking a series of bearings (Bird Island lay north 38 degrees east), descended to a lower shelf of the sandstone. When we had travelled two miles to the north-west, near the eastern edge of the low table-land, we crossed a fourth-magnitude creek with scrub and palms falling to the north-east. In one mile further a similar creek was crossed. Here there was a heavy thundershower.

One mile to the west we camped on a gully falling into the last-named creek. [Camp 47. Latitude by observation of Canopus 12 degrees 2 minutes 30 seconds.]

To-day's travelling has been of a better character than any stage on this side of Attack Creek. The soil has been sandy, and either red or white in colour, according to the varying composition of the sandstone. The grass somewhat sparse, but fairly good in quality. On the higher table-land the timber was mostly stringybark and myall with some box. Vines were plentiful, and we obtained some bunches of good black grapes, almost free of the astringent taste common to Australian wild fruits. On the lower shelf of the table-land, bloodwood timber took the place of box. Heathy flats extended from the base of the sandstone escarpment to the sandhills of the coast.

February 27.—Half-a-mile north of Camp 47 we crossed a third-magnitude creek running strongly to east-south-east. In two miles more to the north, over low and open-timbered country (stringybark and myall), we had crossed the sandstone table-land and reached the low escarpment which formed its northern edge. The scarp is indented here with a deep bay, receding about three miles to the west.

In a mile and a-half to the north through low heathy country (sandstone cement), with gigantic anthills and no timber, we reached a creek of the second or third magnitude, with tea-trees and a few palms, falling to the north-east. The creek was flooded and we had to bridge it by felling a large tea-tree, and ekeing it out with saplings and a rope. The packs and saddles were carried across the creek by the bridge. The horses crossed higher up the creek, at a place where they could just keep their feet, bare-backed. The passage was effected without any mishap, but "Queensland" had, as usual on such occasions to be hoisted up the boggy bank.

There was rain before and after we got into camp, and after dark. The creek rose six inches during the night. We camped on the left bank. [Camp 48.]

February 28.—The morning was fine. In a mile and a-half north 10 degrees west, through sandy country, poorly grassed, timbered with stringybark, bloodwood, myall, and she-oak, and half a-mile to north-north-west, we reached and ascended the scarp of the low sandstone table-land which we had left yesterday. The escarpment of the Sir William Thompson Range was visible about six miles off to the west.

In one mile further to north-north-east a curious bare dome-shaped hill was seen about three miles to the west. The timber was grass-tree, small box, and a few stunted Banksias, with heath.

In a mile and a-half more to north-north-west (the grass-tree having disappeared), we crossed two creeks of the fourth magnitude, running to the east. After half-a-mile of heath, on the same course, we entered an undulating forest country. Heavy rain began here.

From this point we traversed poor forest country with thick undergrowth, approaching scrub in places, for two miles to north-north-west and two and three-quarter miles to the north, crossing five creeks of the fourth magnitude, falling east. We then entered a stretch of more elevated open forest country affording a view of the sea. Large stringybark appeared among the timber. After half-a-mile to the north, over country of this description, we turned to the west to avoid a scrub (in which cypress pines were numerous). In a mile and a-half to the west we camped on the right bank of a gully. [Camp 49.]

All the country traversed to-day was composed of brown gritty sandstone. The forest country was sandy and the heath stony.

February 29.—We left Camp 49, and in half-a-mile to the north-west passed a scrub and crossed the head of a bog. For the next mile north we kept the left bank of a gully draining from the bog through heathy brushwood.

For a mile more, to north-north-east, we kept (through heath) the edge of a bog, apparently continuous with the last. To the left was very thick brushwood. For the next half-mile north we kept the left bank of a fourth-magnitude creek, draining the bog, till the creek fell into a somewhat larger creek coming from the south-west (heath and brushwood). In crossing to the left bank of the latter creek I lost my pocket compass, and had to take Macdonald's. Rain began here, and continued till after we had got into camp.

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In a mile and a-half more to the north-north-west, through heath and brushwood, we crossed a creek of the fourth magnitude, running strongly to the east, over a sandstone bottom. In a mile further, on the same course, through heath and brushwood, we crossed a large fourth-magnitude creek, falling to the east, roaring over a ledge of brown sandstone.

After a mile of travelling to the north, over low heath, we had to cut a passage through a belt of brushwood. In a mile and a-half further to the north, over low open heath, we came to the edge of a dense scrub. Seeing some hills to the east, with forest timber, we made for them, in the hope of finding grass for the horses. The heathy country traversed to-day was utterly destitute of grass.

In half-a-mile (east-north-east) we camped on the left bank of a gully running to the north-west in a patch of stringybark country, with a little very coarse and very poor grass—the worst camp we have had yet. [Camp 50.]

Before coming into camp, Crosbie spied a blackfellow cutting down a tree with an American axe.

Having settled the camp, Crosbie and I ascended the hill to the east. We found it to be composed of sandstone in horizontal beds. Its eastern side was banked up with hillocks of blown sand, closely matted with scrub. At our feet lay a circular lagoon, about a quarter of a mile in diameter, enclosed by sandhills. The lagoon had its outlet in a creek which ran first north and then west, to join the gully on which we were camped.

We could see across Shelburne Bay, with sandhills in the foreground and sandhills on Rodney Point. The sandhills extend inland for about ten miles, and reach an elevation of about three hundred feet—circumstances which point to a recent elevation of the land. Their eastern or seaward slopes are very steep, and their western sides still steeper. Except where the slope is too steep for vegetation, they are covered by a dense low scrub like sloe bushes.

We saw the smokes of several camp fires among the sandhills.

The low-wooded rocks, named the Macarthur Island, lay due east. To the north-north-east we saw the Messrs. Jardine's Richardson Range, whose scarp extends to the south-south-west. It is tolerably distinct, and appears to be covered with dense black scrub. All the intervening country is bleak and wretched in the extreme—bog, heath, and brushwood. To the north-east we saw some clumps of hoop-pine on the sandhills.

The night was cloudy, but no rain fell.

March 1.—One of the prospectors' horses was missing in the morning, and we made a late start in consequence. Rain began as we left, and for three hours some of the heaviest showers of the season aggravated our difficulties with scrubs and bogs.

On leaving Camp 50, we followed the creek down for half-a-mile to the north-west, when we crossed it, and cut our way for a quarter of a mile to the north, through dense scrub, to a deep-flooded forth-magnitude creek running strongly to the north-east. This we ran down for a quarter of a mile to the north-east. On crossing it we emerged on comparatively open stringybark country.

In half-a-mile to the north the open country gradually became heathy, and we were stopped by a third-magnitude creek running strongly to east-north-east, between scrubby banks. Having crossed this, we got on without interruption for three miles to the north, through low open heath on a sandy soil, no grass. At the end of the three miles we crossed a third-magnitude creek, running east, with palms and a little open forest country and grass on the left bank.

The next mile, north-north-west, was utterly grassless, the only vegetation being low heath; then we headed a bog in half-a-mile to the west.

In a mile to the north we reached a fourth-magnitude creek, with palms (*Seaforthia.*) The country was improving a little.

In half-a-mile to the north-west, through open forest country, most of the way up the right bank of a gully fringed with dense scrub and palms, we crossed the gully, and reached in a quarter of a mile to the north a fourth-magnitude creek running east, with a scrub which we had to cut.

A mile to the north, through forest country, ironbark, nondah, and tea-tree, with a thick undergrowth of brushwood, with little grass but spinifex, we crossed a gully falling to the east, with a wide belt of scrub on either bank.

The next half-a-mile, north-north-west, was through long heath. In half-a-mile further to the west, over stony ridges with she-oak and wire-grass, we camped on a gully which had some coarse grass on its left bank.

Camp 51.—I ascended the hill behind the camp with Mr. Crosbie, and took a series of bearings.

Rodney Point	... ...	bore East 36° South.
Macarthur and Bird Island	...	„ East 22° South to East 36° South.
Hannibal Island	... ...	„ East 10° North, and East 12° North.

No rain fell in the night.

March 2.—We left Camp 51. For the first two miles and a-half we crossed numerous gullies, and passed a bare promontory of the Richardson Range.

In a mile to the north we sidled with ease up the scarp of the Richardson Range. "Greenhide" stumbled into a gully. He had carried Charlie till a few days ago, when he seemed weak, and was accommodated with a light pack. When he fell into the gully he was unpacked, and it took an hour at least to raise him, though the ground was hard. He either could or would make no effort to help himself. His pack was put on "Queensland" for the rest of the day. He seemed to be constipated, but otherwise we could not discover what was the matter with him.

In one mile to the north, on the top of the sandstone hills (Richardson Range), through thick vine, palm, and fruit-tree scrub (which had to be cut), we crossed a fourth-magnitude creek running east. We then coasted a scrub for half-a-mile to west north-west, when we cut a passage through it (in the same direction). It proved to be only a narrow belt.

In a quarter of a mile to the north, through heathy country, we reached a fourth-magnitude creek running north-west and fringed with a dense scrub, which had to be cut through.

Half-a-mile more of open country (to the north), brought us to a boggy pandanus gully, running north-west. A bridge had to be built over this gully before we could cross it.

Half-a-mile to the east, half of the distance up a second pandanus gully, also falling to the north-west, we crossed the gully and were stopped by a scrub (which we had to cut) fringing a gully falling to the south.

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One mile to the north, through forest timber, with an undergrowth of brushwood, we reached a dense scrub, through which we had to cut our way.

In half-a-mile north-north-east (down off the table-land, a scarcely noticeable descent), over heath and brush, we reached a fourth-magnitude creek, running west-north-west. We followed it down for a quarter of a mile, and crossed to the right bank.

In two miles further north-north-east we were pulled up by a scrub, and having got water in a gully, and a little very coarse grass, we camped just at nightfall. [Camp 52.]

"Brownie" was tied up close by the site of the cook's tent. When the tents had been put up and the fire lit, we discovered that "Brownie" had slipped his head out of the halter and vanished. As his packs contained all our eatables, besides Love's tent and swag, and the night was dark and rainy, our concern may be imagined. After some earnest searching by all hands he was caught by Macdonald.

Rain fell nearly all day; but there was not much during the night.

March 3.—The horses were all scattered in the morning, and it took a long time to find them. The last of the prospectors' horses was found by Charlie by two o'clock, but one little mare of mine, named "Olive," was still missing. While the horses were being sought for in the morning I penetrated the scrub to the north-east for a mile and a-half, but found no end to it. It turned out to be a belt fringing a gully running north-west. I got a very heavy shower on my way back. Charlie, Macdonald, and I sought for "Olive" for two hours more, but were still unsuccessful. There were innumerable pockets in the scrub, in any one of which she might be concealed.

When Crosbie's horses were all found he pushed on in the hope of finding a grassy camp, as the horses could not live at the present place.

At three o'clock we packed up and followed on Crosbie's tracks, resolved, if we found a fair camp, to spend the next day in searching for "Olive." We all felt that "Olive," though a weedy little mare, was indispensable to us, as she always followed the leader like a dog, and formed an invaluable head for the train of packhorses.

Following Crosbie's tracks, we kept to the north-west for half-a-mile on the edge of the scrub; then for a mile and a-half, the first quarter of a mile through a path cut in a dense scrub. Part of the track coincided with a track cut one or two seasons ago by the natives. The rest of the distance was half forest, half scrub, with, however, no grass. Here we crossed to the right bank of a fourth-magnitude creek (flooded) running to the north-west—the head, I believe, of the river which proved the crowning difficulty of the Messrs. Jardines' eventful journey in 1865. The brothers Jardine believed that the river (to which afterwards their own name was given) was the Escape River of Kennedy, and followed it down to the north and west for days in the daily expectation of rounding its angle and getting away to the north, till their doubts were set at rest by its falling into the Gulf.

In a quarter of a mile to the north, through scrub, we reached a gully which the prospectors had had to bridge over. Here we overtook them, their progress through such country having been necessarily very slow.

In half-a-mile more to the north-north-west, through a dense scrub in which a lane had to be cut, we found ourselves in a sort of pocket, in which we camped just as it was becoming dark. Crosbie and I went on about a mile to the north through thick scrub, but found no end to it in that direction. Crosbie and Layland then tried about a mile to the west-north-west, but found only another somewhat open pocket, no better than that in which we camped. [Camp 53.]

Water for the billy had to be brought from the gully with the bridge. As the grass was very limited in quantity and poor in quality, and as some of the horses exhibited symptoms which led us to suspect the presence of some poisonous herb among the grass at last camp, and as there was no water at the camp, I judged that there was no chance of the horses being found in the morning, and had them all tied up, with the exception of four of the weakest, which we hobbled and belled ("Queensland," "Greenhide," "Greyhound," and "Billy").

There were heavy showers during the night.

March 4.—It rained very heavily up to 11 o'clock, and the whole day was dull and threatening.

Our position had now become very serious. Two courses lay before us. To push on was to run the risk of a third night's camp without grass, involving the loss of all the horses, and leaving us to find our way to Somerset, or the sea-coast, with as much of the bare necessaries of life as we could carry on our backs. On the other hand, if we retraced our steps, with the view of striking for the beach in the hope of finding better travelling, we knew that the nearest grass was at Camp 51, thirteen miles off. Whether the horses, weakened by two nights of starvation, could cover the distance, was a matter of doubt.

Crosbie chose the former course, and I the latter, the additional chance which it offered of finding "Olive" deciding me in its favour. We agreed to meet near Pudding-pan Hill, between Orford Ness and False Orford Ness.

The day proved a very disastrous one. Two of the horses that had been allowed to feed last night knocked up, and had to be abandoned, with, of course, the chance of recovering them if they lived. First, "Greenhide" (carrying only an empty pack-saddle), after having been dug out of a steep-banked gully into which he had plunged, lay down on the north side of a boggy gully on the table-land between camps 51 and 52, and could not be got to his feet. His saddle was hidden, and the place marked; but just as we were about to leave him he rose up of his own accord. We got him across the gully, and on for about half-a-mile, when he lay down again, and this time had to be left behind. "Queensland" began to show signs of distress at the place where "Greenhide" first lay down. In a couple of miles he was bathed in perspiration and hardly able to walk. We put his very light load on "Ben." In half-a-mile more I dismounted, and led "Queensland," while Love drove him forward. I hoped, at least, to get him off the table-land, where he would be among grass, and in a position to join the other horses at Camp 51, should he recover; but a mile or so short of the descent he staggered, and fell into a gully. The best we could do for him was to drag him into a place where he could not be drowned, and from which he might rise if he regained sufficient strength to do so.

"Greyhound," another of the horses allowed to feed last night, came into camp bathed in perspiration, and exhibiting the same symptoms as "Queensland."

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I have no doubt that as three out of the four horses allowed to feed at Camp 53 fell ill on the day's journey, while the horses which were tied up suffered from nothing worse than starvation, they must have eaten some poisonous herb.

We reached Camp 51 at dusk. [Camp 54.]

March 5.—While mustering the horses in the morning, Charlie detected the footprints of four or five natives, who had followed our northward track from Camp 51. This circumstance was notable, as we had never been followed since the 12th of January. Our new followers were probably from the sand-hills near Camp 50, and unacquainted with the transactions of the Peach and the long shot in the Nisbet Valley.

Heavy rain began before daylight and lasted till ten o'clock. Afterwards the sun was strong, and Love and I had a busy day repacking and drying rations, clothes, bedding, and ammunition, and mending harness.

Charlie and Macdonald went back to Camp 52, got "Olive's" tracks, and found and brought her back. "Greenhide" had got up, but had all the symptoms of poisoning. He was driven for a short distance, but lay down again, and could not be induced to rise. "Queensland" had also risen, but could only crawl along a short way "on his hocks."

I ascended a bare promontory of the sandstone hills, half-a-mile from the camp, and saw clear low heath for five miles to the east. There appeared to be passable travelling (brushwood and low trees) to east 30 degrees north, in line with a wooded island (Boydong Cays?).

March 6.—The night and morning were fine. Rain began, however, when we started to leave Camp 54, and continued to fall heavily till the afternoon.

We followed our northward track for two miles to the point where we began the ascent of the Richardson Range. From this point we struck to the north-east, for a promontory which I had seen yesterday, where I hoped to find grass for the horses, and where I could make a last effort to save "Queensland" and "Greenhide." "Greyhound" was, however, already about to give up, and in a quarter of a mile we were stopped by a dense scrub. After penetrating this on foot for some distance, I returned to the horses, and, taking into consideration the condition of "Greyhound," and the chance of making but small progress at the best in such weather, we retraced our steps for three-quarters of a mile to the nearest grass, and camped two and a-half miles north of Camp 54. [Camp 55.]

The rain ceased by two o'clock, and Charlie and I walked to the point we had made for in the morning. It lay north-east of the camp. We sidled up the range by the track and then followed the edge of the ranges round to the promontory, a distance of about two miles. We found that the top of the eastern scarp was the very divide of the peninsula. There was not a single gully to cross. Still better, there was not a stick of scrub to cut, although the scrub commenced a few yards back from the top of the escarpment.

A very old native track led down from the promontory to the low ground on the east. It seemed practicable to get down by this route to the sea in about seven miles, keeping on the divide between two creeks, without encountering any great extent of scrub.

"Greyhound's" is a very doubtful case, and it is hard to say whether he can travel another stage. I gave him a large dose of antibilious pills, as constipation seemed to be his only complaint recognisable.

The night was fine.

March 7.—To lighten the packs we abandoned twenty slippers, a jar of arsenical soap, a lot of odds and ends of saddlery designed for mendings, and the packsaddles of "Greenhide," "Queensland," and "Greyhound," as it had become questionable whether any one of the poor beasts could even "carry his hide" to Somerset. "Greyhound" seems better to-day.

The day was dull and threatening, but there was only one heavy shower.

Charlie and I visited "Greenhide" and "Queensland." The former was evidently in a dying condition, and scarcely took any notice of us; he had wasted to a mere skeleton. His legs were much swollen and he could hardly walk. The skin on his quarters was cracked and running. He was covered with flies from head to foot.

"Queensland" seemed a good deal better. We drove him on (and he followed Charlie's lead quite intelligently, needing but little driving) to a point below the promontory which Charlie and I visited yesterday, where there was good grass and plenty of water. At this point we could pick him up on the next day's stage, and save him at least two miles of travelling.

March 8.—Leaving Camp 55, we kept the top of the escarpment to the point where we left "Queensland." We found him dead. He had fallen down about 30 yards from a gully, and struggled down to it to die.

For a mile and a-half to the east we travelled through rather thick whip-stick brush to a belt of scrub fringing the fourth-magnitude creek which comes down from the Richardson Range north of where we left it. We found a good crossing and open country beyond. At the crossing, however, poor "Greyhound" stumbled and fell back. He was rolled over and set on his legs, but as I was leading him up the bank by the halter he tumbled back again, and this time could not be got up. There was no fear of his drowning. We cut away his saddle (all he was carrying) to give him a chance for life, and left him.

In half-a-mile to the north-east we headed a bog, and then continued for two miles to the east along the edge of a ridge, covered with cypress pine scrub, till we crossed to the left bank of a fourth-magnitude creek bordered with palms.

For two miles more to the east we traversed well-grassed country, with belts of scrub and gullies falling to the south-east. The next three miles through good grassy country to east-south-east, along the edge of a dense scrub fringing a creek, brought us within sight of the sea. We could not, however, get down to the beach, as another scrub turned us a mile to the south. Here we camped, as it was now late in the afternoon. [Camp 56.]

Just as we came in sight of the sea Charlie espied a blackfellow. From his signals to me I thought it was a kangaroo or emu, and unslung my rifle and dismounted. Charlie's idea was that we should simultaneously fire at the blackfellow to make sure of him, but I declined the sport, to Charlie's intense disgust and amazement. The native on seeing us slipped into the scrub, and presently a hullaballoo arose which proved the presence of a large number of natives, including women and children in considerable numbers.

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The day and night were fine and no rain fell.

March 9.—In the morning, as were packing, the blacks showed up. Two of them—one especially—spoke very fair English. We admitted the two to a parley outside the camp. Afterwards two more joined them, but we insisted that the remainder should keep at a distance. The spokesman assured us that there was "plenty fish" and "plenty beebel'm." They hailed us brothers and insisted on shaking hands. The principal spokesman introduced himself as Captain Billy, and said that he and his men had several canoes and fished extensively. They expressed themselves anxious to barter fish and turtle for tobacco, flour, trousers, shirts, tomahawks, and "big fellow money." We declined the offer at first, and asked them to show us the best way down to the beach. They guided us down to the sea in about half-a-mile by a native track. Billy accompanied us along the beach (his fellows part of the way keeping us in view from the cliffs above) to a creek of the third magnitude, which bore west 5 degrees from the south northmost of the Hannibal Islands. In the mouth of the creek was a very fine, large outrigger canoe. At this creek, which I named after Captain Billy, the captain left us, professedly for a drink of water, but evidently for the purpose of joining his friends.

In three-quarters of a mile we crossed the mouth of a fourth-magnitude creek. The tide was high and the packs just cleared the water.

Shortly after crossing this creek we mounted to the top of the sandstone cliffs, which here came close to the edge of the sea. We had travelled for about a mile when we detected two natives with spears, couched in the grass; we cautioned them and dismissed them. A large canoe containing five or six men was at the same time seen paddling in-shore. Three or four blacks could be seen coming up behind us armed with spears. Billy came up shortly and appeared anxious that we should wait for the men in the canoe, who were likely to have brought some fish, and who were, he asserted, "all very good men."

On getting down to the beach again, Billy and his friend of the morning came panting up with some of the canoe's crew. They renewed the offer to bring fish, and we sent them off promising to give them tobacco if they brought fish, but repeating the caution that only two were to come, and to come unarmed. Billy protested his sincerity in the words—"No gammon—gammon no good."

Half-a-mile after we had descended to the beach (low sand-hills extending inland for some distance, with a few patches of mangrove at half-tide) we reached a third-magnitude creek, whose mouth bore west 10 degrees north from the larger Hannibal Island.

For about four miles further we kept the beach by low sand-hills which stretched a long way inland.

After two miles more, by low sand-hills on the top of low sandstone shelves, we rounded a point of the latter where I thought of camping. Four or five blacks were seen coming up behind with spears, and we went back to meet them. They offered us one fish. Before coming up they had dropped their spears, which we found. They were not fish-spears—one of them, with a long iron barb, I was destined to become better acquainted with before long.

As we had repeatedly warned Billy that he and his companions were not to bring spears, we could no longer doubt that they meant mischief. We sent them away for the last time, warning them that we would fire on them if they again approached, and as the place did not afford a good camp for defence we moved on.

Two miles farther we rounded a sandstone promontory, and crossed a somewhat boggy creek of the second or third magnitude, afterwards named Camisade Creek. The blacks, who probably expected to find us thrown into disorder by the boggy creek, were now seen coming up behind, about fifteen strong, armed with spears, evidently with hostile intent. We got as near as we could (about 150 yards) and fired. Unfortunately we missed them, and the blacks fled.

We camped on the north side of the creek on an open sand-patch, well grassed, and separated from a scrub by the back waters of the creek. The camp bore west 33 degrees south from Half-way Island, and north-west from the outermost island of the Hannibal Group. [Camp 57.]

I have been blamed in some quarters for a want of firmness in not having shot some of the blacks on the first appearance of treachery; and it is easy to see that an opportunity of striking terror and inspiring respect occurred when the two natives were found hidden in the grass. I refrained from taking advantage of that opportunity, simply in the hope that the affair might be got over without bloodshed, and from a disinclination to commence hostilities which might result in the loss of more of our horses, and we could spare no more. We had been free of the despicable savage warfare ever since we left the Nisbet Valley, and I was in the last degree averse to renewing the strife with a new tribe.

The night was fine and starry. Considering the terms on which we were with our neighbours, I set a watch of two and a-half hours per man, the man on duty to keep the horses together and look after the safety of the camp. Macdonald and I had finished our watches, and I had turned in for about twenty minutes, leaving Love on guard. I was dozing off to sleep, when a spear came from the edge of the scrub on the other side of the waterhole, pierced the fly, and crashed through my neck above the right shoulder-blade, injuring the deltoid muscle. I rose on my elbow and reached for my revolver, when a second spear transfixed the stretcher from which I had just lifted my head. I gave the alarm, and carried my sheath-knife to Macdonald, and caused him to cut the flesh (about a quarter of an inch in thickness) above the spear. It would no doubt have been better to have cut the spear and drawn it out, but it was so firmly fixed by the tension of the surrounding muscles that all my strength was insufficient to move it. The spear, besides, was of very thick hardwood, and to have cut it would have taken several minutes. Naturally I expected that the flight of spears would be followed up by an immediate attack on the camp; and while I had a spear eight feet in length dangling across my shoulder I could not have counted for much in the defence.

Charlie, it appears, had heard the blacks stealing down into the waterhole from the scrub. He had tried, as he said, to wake Macdonald, who was sleeping in the same tent. He probably tried, if at all, very gently. As, however, Macdonald did not wake, Charlie's heart failed him, and he crept out of the tent and made straight for Somerset. Love (who had been rounding up the horses), hearing the alarm at the camp, and seeing a naked blackfellow bounding along the beach, dropped on one knee and fired two shots at Charlie, which pulled him up, frightened but unhurt.

All hands kept watch for the remainder of the night, and a fusilade was kept up into the scrub. About an hour after the attack Macdonald saw two of the blacks at the edge of the scrub, and some shots were fired in the direction, but I think they did no good. Nero, our dog, got on the tracks of the assailants, and we heard him captured by them, but he returned in about an hour.

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The spear which struck me was eight feet in length, and an inch in thickness at the shoulder. The last two feet of it were formed of a light grass-tree stem hollowed out at the end for the insertion of the claw of the wimmera. It was barbed with seven inches of quarter-inch iron rod beautifully pointed at both ends. It had penetrated the side of my neck for thirteen inches over the point, and rested with its thickest part buried in the flesh. It made, as may be imagined, an ugly wound which partially disabled me for the rest of the journey.

The spears which entered my tent passed directly over Love's stretcher, and must have killed him had he been asleep, as the blacks had been cunning enough to stand in the waterhole at a level which enabled them to rake the floors of the tents with their spears. Charlie had saved himself, as has already been related. Macdonald's tent had three spears in it, besides one which had fallen short outside. His personal safety was owing to the fact that he slept on the lee-side of a pile of pack-saddles and rations. An idea of the force with which spears may be propelled by wimmeras may be gathered from the fact that a spear was found to have penetrated a bag of rice, and entered the tin covering of an oil-bottle, which was broken by the shock.

March 10.—It would have been useless to have attempted to follow the blacks, who could easily have escaped to the islands in their canoes. The condition of our horses and rations alike made it imperative that we should push on without the loss of a day, and if possible rejoin the prospectors.

Before leaving the scene of the attack, we broke up and burned the collection of spears which had been thus unexpectedly forced on us. Quite an armful was picked up round the tents.

Three miles from Camisade Creek we had to wait for three hours at the mouth of a third-magnitude creek for the fall of the tide. The place bore west 15 degrees south from Halfway Island.

In two miles further we came on a camp of the prospectors, with their tracks leading northward from it. In three miles more we found them on False Orford Ness. and camped beside them. [Camp 58.]

To-day's stage was very easy travelling on a narrow strip of moderately hard sand. Above that was a raised beach ten or twelve feet high, which in places extended inland for nearly a quarter of a mile. The raised beach was covered more or less with hills of blown sand. North of the creek where we waited for the tide to fall, the sand-hills abutted on hills of sandstone (bare or heath-covered) three or four hundred feet in height.

We encountered no rain on our journey, but there had been a heavy shower at False Orford Ness in the morning. There was heavy rain after dark. The "Normanby" steamer, from Hongkong, was seen passing south about 8 o'clock.

The prospectors had had a very trying time since we parted. Their horses, which were allowed to feed at Camp 53, were all more or less ill. Two of them they thought certain to die. They had heavy rains, heavy scrub cutting, creeks to bridge, and no feed for the horses. Their route has been charted from Mr. Crosbie's notes.

Crosbie dressed and poulticed my wound, and he and his party overwhelmed me with kindness. For some days the wound was so painful that I had to be hoisted into the saddle and lifted out of it.

March 11.—Spelling horses and myself. A steamer passed south about 8 p.m.

March 12.—Spelling horses. Crosbie shot the mare which had given so much trouble at the outset of our journey. From the exuberance of her spirits she had blundered down to the seaside at low water, and, as she was unable to rise, would have been drowned when the tide rose.

Three ships appeared off Orford Ness about 2 o'clock, going south. In case they should come near enough to be hailed, I wrote letters, but the ships (which turned out to be *bêche-de-mer* craft) anchored off Cairncross Island at sunset, and in the morning were seen outside of Halfway Island.

False Orford Ness is a low promontory of horizontally-bedded red sandstone coming down in a cliff to the sea. The Ness is covered (lightly near the sea) with blown sand, which accumulates inland into high sand-hills. These extend inland for two or three miles till they abut on a range of heath-clad sandstone hills.

March 13.—Left Camp 58. From Orford Ness to False Orford Ness low points of sandstone come down at intervals to the sea. The sandstone is covered with sand-hills, which extend westward for some distance. About three miles from Orford Ness two blackfellows were seen far back on our tracks.

Near Orford Ness we saw the tracks of two turtles.

On Orford Ness we found the capstan of a ship.

In the southern height of Orford Bay we found a large inlet among the mangroves with four mouths. The crossing of the first mouth was dangerous—a thin and treacherous crust of sand on stiff black clay. Some of the horses sunk deeply in the clay. "Ross," with my packs, fared worst, and my maps and note-books were submerged. While we were in these straits our ears were regaled with the howls of a number of natives in the mangroves. At the next mouth we had to wait an hour for the tide to fall. The next two mouths presented no difficulty, as the tide was low.

Orford Bay is a broad stretch of sandy beach bordered with low sand-hills, which, apparently, go a long way inland.

About a mile beyond the last mouth of the tidal inlet a large outrigger canoe was drawn up on the beach, and seven or eight natives stood about it. They carried their luggage leisurely into the scrubby sand-hills while we were crossing the inlet. Crosbie, Layland, Love, and Charlie galloped towards three who remained beside the canoe till they were within a quarter of a mile, when they disappeared among the sand-hills. In a mile more we sighted seven gins and a piccaninny coming to meet us, the gins all carrying heavy swags. They retired into the sand-hills, and came down to the beach again when we had passed. It was probably the removing of a camp, the men having come by the canoe while the women carried the luggage overland.

There was only one light shower to-day, but heavy rain fell during the night. We camped on the Red Cliffs, in latitude 11 degrees 14 minutes south.

Camp 59.—One of Crosbie's horses had to be abandoned a mile short of the camp. "Coen" gave sudden signs of his old complaint, and "Brownie" is getting very feeble.

March 14.—For most of the day we kept on the top of the sandstone cliffs, having to cut two large scrubs behind the first tier of sand-hills above the "remarkable red cliffs." A fourth-magnitude creek empties into the sea a mile north of Camp 59, and another midway between the "remarkable red cliffs"

cliffs" and "No. II. Point." The sandstone cliffs become higher to the north. At No. II. Point they are about 150 feet in height. They are bare, or nearly so, for a little way back from the sea, but inland they are covered with blown sand to a height of about 300 feet above the sea level. We camped about a mile south of No. II. Point.

Camp 60.—Heavy rain began about midday, and continued till we had got into camp. The night was threatening, but there was no rain, and only a short gale.

March 15.—Heavy rain began at daybreak, and continued with slight intermission till 4 o'clock. Travelling was impossible. Gales and a few showers during the night.

March 16.—The morning was fine and breezy, although cloudy. On leaving Camp 60 we had good travelling on the top of sandstone cliffs, nearly 200 feet high, without interruption, to the bay south of Flat Hill, where we were stopped by the mouth of a large mangrove-skirted creek. The tide was only about a foot from its highest, and we waited two hours before we could get across. This creek, which would form a haven for small craft, I named the Henderson, after the Hydraulic Engineer of Queensland.

From Henderson Creek northward the cliffs were low, though often precipitous, and the scrubby sand-hills at times came close to the sea, and we had difficulty in getting up from and down to the beach when necessary.

We camped opposite an uncharted islet (horizontal sandstone), at a place bearing south 26 degrees west from the south-east end of Tern Island. [Camp 61.]

The red sandstone at camps 60 and 61 has an oolitic structure, and is highly ferruginous. There is evidently a very gentle dip from the Carron Range, so that as we proceed north we gradually pass over higher beds.

From some high ground near Tern Cliff I saw the north mouth of the Escape River, and some high ground lying north 20 degrees west which I took to be Fly Point.

March 17.—The horses had got so weak that we found it necessary to give them a day's rest at Camp 61. Crosbie went on to Shadwell Point. Shadwell Peak is a high sand-hill.

We regaled on oysters, crabs, and lobsters while the horses were recruiting. The day and night were fine, but a few showers fell towards morning.

March 18.—We had now kept the beach far enough, as we thought, to be able to steer a straight course to the west, between the Jardine and the Escape Rivers, for the head of the Kennedy.

A course of west 30 degrees north we imagined would take us clear of the Escape River. We travelled for four miles in that direction, on well-grassed, soft, red sandy ridges, timbered with bloodwood, box, stringybark, and wattle. For a mile more to the north-west we kept the crest of a white sand-ridge, with a lagoon to the right, and a scrub in a hollow to the left.

For two miles west 10 degrees north we traversed low, grassy, forest country, with thin belts of scrub running parallel to our course, till we came to a saltwater creek fringed with mangroves. This creek (a tributary of the Escape River) was deep and boggy, and though of scarcely more than the fourth magnitude, bore us for a mile to the south. There the mangroves gave place to scrub with palms, &c., and the creek became a swift-running fresh-water brook. We crossed it just above its junction with a deep gully, two feet wide, over which a substantial bridge had to be built with saplings. "Diver," getting wide of the bridge, fell into the water, and his packs went down the stream and were rapidly carried out of sight, and only recovered after much trouble. A good deal of sugar and some cartridges were destroyed, the pack-saddle was broken, and all Hume's clothes and bedding were soaked.

After two miles of travelling to west 10 degrees south (the first mile through "flooded country," from which we gladly emerged on well-grassed forest land) we reached the edge of a bog, on the further side of which a valley with mangroves (the Escape) separated us from a low sandstone table-land.

Camp 62.—Crosbie penetrated through the bog and mangroves—a very difficult task—and saw the Escape. The river, or rather arm of the sea, was about half-a-mile wide, with no perceptible current.

The day was fine, but a little rain fell as we got into camp. The night was fine.

March 19.—As crossing the Escape with horses was simply impossible, there was no help for it but to run it up till it became a fordable fresh-water creek.

For two miles to south-south-east, on soft, grassy, timbered ridges, we kept the mangroves in sight; then the mangroves disappeared, and we thought the inlet was going to die off in swamps, one of which, with its gully, we crossed on our course.

In one mile further south 10 degrees east, over stony and grassy timbered ridges (brown ferruginous sandstone and oolite), just as I thought we were at last rid of the Escape, we were stopped by a narrow pitcher-plant swamp, which forced us two miles to the east before we could head it.

In two and a-half miles to south-south-east, by stony ridges capped with scrub, and intersected by heathy and pitcher-plant bogs, we reached the Escape River, here a fresh-water creek of the third magnitude. On running it up for half-a-mile to the south-east, through scrub and brushwood, we found it split up into two branches. The left branch came from the north-north-east. We ran it up for half-a-mile, through boggy heath, when, finding that it was not fordable, we made for the nearest grass and camped. [Camp 63.]

The morning was fine, but heavy rain began about midday, and continued to fall till after we had got into camp. A little rain fell during the night.

March 20.—The morning was fine. Heavy rain began about midday, and fell for three hours or so. Crosbie crossed the two branches of the Escape River, and got away for about two miles to the west through low, heathy country. When he returned the rain had set in, and it was too late to move the camp when he returned.

March 21.—We left Camp 63, and crossed the northmost branch, and in half-a-mile to the south the southmost branch of the Escape (a fourth and third magnitude creek respectively). At the latter we had to unpack the horses and carry the goods across a bridge of saplings, while the horses were crossed about a quarter of a mile higher, just aswim. Rain began as we were repacking, and lasted for two hours.

After leaving the Escape we travelled for half-a-mile to west 10 degrees south over heath and pitcher-plant bogs. For the next half-mile to the west we passed over rather higher ground, with oaks, pandanus, and stringybark (oolite), and reached a fourth-magnitude creek running north—the last of the

the Escape waters. In two miles to the south we headed the creek. For the first half-mile we had to cut through scrub, but the rest was small timber with heathy undergrowth. The rocks were oolite and sandstone. In the two miles we ascended about 250 feet.

For one mile to the south-west we kept the crown of the divide of the peninsula (between the Escape and Jardine waters). For a similar distance we kept to west-south-west down a very gentle grassy slope, thickly timbered with stringybarks, oaks, nondahs, &c., with a scrub to the left and a bog to the right. We camped on the latter, as it was now near sunset. [Camp 64.]

No rain fell during the night.

Six days had now elapsed since we left Camp 61, and we were now only eight miles to the west, the Escape River having forced us to a course which was totally unexpected.

March 22.—Our next anxiety was to clear the Kennedy River above the tidal waters, and with that view we aimed to keep on the head of the Jardine waters.

Leaving Camp 64, for one mile to west-north-west, three-quarters of a mile west-south-west, and three-quarters of a mile west-north-west, we kept nearly on the divide; and for a mile and a-half to the north-east we ran up the left bank of a pandanus bog with a fourth-magnitude creek, one of the tributaries of the Jardine.

In one mile further to west-north-west we reached the edge of a scrub covering the short steep slope of the eastern fall; we kept the edge of the scrub for a mile farther to west-north-west and camped. [Camp 65.]

Here, for the first time since we left the neighbourhood of Cooktown, we saw the tracks and dung of cattle.

A heavy shower fell about an hour after we left the camp in the morning; the afternoon and night were fine.

March 23.—There was heavy rain at daybreak, and the day was dull and threatening. We did not move camp, as two of Crosbie's horses were knocked up, and one of mine ("Poodle") was getting very weak. Crosbie and Layland went out to the west about three miles.

March 24.—There was heavy rain before daybreak.

On leaving Camp 65, we held for three and a-half miles west 10 degrees north, the first two miles being through closely-timbered and well-grassed country, just below the divide; the rest heathy or covered with wire-grass, with pitcher-plant bogs falling to the left. One of these, at three and a-half miles from the camp, ran us about a mile to the north. I left "Poodle" at one end of this bog, and Crosbie had to abandon one of his horses ("Paddy") at the other end.

In two and three-quarter miles further, through poor country with oaks and wire-grass, we passed a belt of scrub, and on finding some better grass on the banks of a boggy gully falling to the south-west, we camped. [Camp 66.]

March 25.—The night was fine till about an hour before daybreak, when rain began. The rain continued with slight intermission till two o'clock. The horses were all scattered: the last of mine was found at nine, but six of Crosbie's were not found till three o'clock, so that we could not move camp.

March 26.—The night was fine and the morning was sunny. Only one shower fell at midday.

Leaving Camp 66, we kept the divide for two miles to west-north-west. There was fair grass and timber, comprising stringybark, bloodwood, myall-wood, and nondah. On reaching a pitcher-plant bog, falling to the north (Kennedy waters), we headed it in a quarter of a mile to the west.

For a mile and a-half to the west, 10 degrees north, we kept the crown of a divide till we reached a valley, with high ground beyond, running a little to the west of north.

For the next three-quarters of a mile we ran down the right bank of a fourth-magnitude creek, flanked by a pitcher-plant bog, till the creek was joined by a gully coming from the east. We crossed the latter with some difficulty, and kept the right bank of the joint stream for three-quarters of a mile to the west, on the summit of a low ridge, covered with forest trees.

In a mile and a-half to the north-west, gently descending through closely-timbered country (stringybark, bloodwood, and myall), fairly-well grassed, Crosbie climbed a high tree on a rise, and saw the mangroves of a branch of the Kennedy, half-a-mile to the north. He could see across the estuary of the Kennedy to the point of Albany Island.

In the hope of heading this branch of the Kennedy, we altered our course. In three-quarters of a mile we reached a bog, fringing a canal-like creek of the third magnitude. As it appeared that we should have to bridge this creek, and the day was getting late, we camped.

Camp 67.—After we had camped, I went down the bog, and penetrated through the mangroves and mud to the salt water. It was running to the north-east, about forty feet wide and a foot deep. Oysters and other sea-shells were common among the mangrove roots.

Half-a-mile below the camp, I heard the creek roaring over rapids, and found a practicable crossing on a sandstone bar. A very old native track came up the right bank of the creek and crossed at the bar. I crossed, and found another canal-like branch of the creek, in the same flat (not quite so large as that on which we were camped). This also was passable by a ford on a bar of sandstone.

March 27.—The night was fine. Leaving Camp 67, we crossed the two creeks in half-a-mile to the north-west. We were under the impression that the saltwater creek we had just cleared was the head of the Kennedy River or inlet, but it proved to be only a branch.

For one mile further to the north-west we travelled on a round ridge (timbered with stringybark) by the edge of a bog which fell into the branch of the Kennedy we had just left. After a time the bog began to send its waters to the west (although no fall was perceptible to the eye) into a mangrove swamp with a slow stream.

Perceiving that we were not yet clear of the Kennedy, Crosbie and I went for a mile further to the north-west and struck the Kennedy Inlet. It was a sheet of salt water about a quarter of a mile in width, and running slowly from west to east. Presuming that the inlet is correctly laid down on the Admiralty chart, this east-and-west reach must be that which coincides for about a mile with the eleventh parallel of latitude. The chart shows the river for about two miles to the south-west of the east-and-west reach, with a note :—"2 feet at L.W. Springs. Tide rises about 7 feet. A boat can proceed 1½ mile higher up, when the R. is lost in swamps." It was evident that we had still three and a-half miles of the saltwater inlet *and* some swamps to head before we were clear of the Kennedy.

On

On returning to the party we altered our course to the south-west. In a mile we had crossed the bog and emerged on a stringybark ridge; in two miles we crossed the ridge and struck a bog falling to the north. The bog was headed in half-a-mile to the south.

In a mile to west-south-west we crossed a stringybark ridge, ascending and descending about fifty feet, and reached a fourth-magnitude creek falling to the west and flanked by a pitcher-plant and pandanus bog. We ran down the right bank of the bog for one mile to the west and half-a-mile to west-north-west. As, however, the country appeared to become less grassy and more heathy as we went on, we retraced our steps for half-a-mile and camped.

Camp 68.—Cattle dung was plentiful at this camp. Rain fell from the start in the morning till two o'clock. There was also a heavy shower at sunset.

I followed the creek for about a mile down from the camp, till it began to run to the north-east. Some sea shells were seen here in a blacks' camp. This creek is probably the main head of the Kennedy. The creek was deep and narrow like a canal and very rapid, but I thought it could be forded in one place if it should fall a little during the night.

March 28.—There was one shower before daybreak.

To-day's living being provided for by yesterday's baking, I divided the rest of the flour (25lbs.) into five days' rations. We were thus provided for this and other five days, which we all thought ample time to allow for covering the thirty miles which now divided us from Somerset. In the worst case possible, we were now so near our destination that when our rations ran out we had only to leave the horses and go on on foot for supplies.

Five of the prospectors' horses were missing in the morning, and were not found till mid-day. Crosbie inspected my "possible" crossing, but found it still impracticable, as the water had rather risen than fallen.

After breakfast Crosbie and I crossed the creek half-a-mile below the camp, at a place where it branches into two creeks of the fourth magnitude. We found practicable crossings of both, and went on to the west-north-west for a mile, across a stringybark ridge, to another bog falling into the one we had left. Crosbie got up a tree here and saw the valley draining to the east.

On the way back Crosbie was engaged in improving the crossing with the shovel when a very heavy shower came on and speedily made the creek impassable.

On leaving Camp 68 we built a substantial bridge over the creek below the junction of its two branches. In one mile we reached the bog falling east, and headed it in a quarter of a mile to the south.

In two miles to the north-west and half-a-mile to the north, with a rise of eighty feet, and no great fall, we reached a bog falling to the north-west. On running it down for half-a-mile a tributary valley or bog was seen to come in from the north, and some high ground could be seen up the valley. We ran the bog down for about a quarter of a mile further to the west, and when it turned to the south of west, crossed it. The bog had a broad sheet of water about two feet deep in two channels. It looked very formidable, but proved easy, as the bottom was sound.

This creek running to the west must be one of the tributaries of the Jardine River, and as we had passed the Kennedy we congratulated ourselves that there was now nothing to prevent our striking a direct course for Somerset.

On the right bank of the creek we camped on a stringybark ridge with fair grass, just at sunset. [Camp 69.] There were showers while we were pitching the tents.

March 29.—There was rain a little before daybreak. The day was dull, but no rain fell.

Leaving Camp 69, we kept for half-a-mile to north-north-east, on the crown of a well-grassed stringybark ridge, with red soil (derived from sandstone), rising about 40 feet and falling about 20.

In half-a-mile to the north-east we crossed a well-grassed valley to a pandanus bog falling to the west. A scrubby hill, about 200 feet higher, overlooked the right bank. We ran the bog up for a quarter of a mile to the east, and crossed near its head.

In two miles to the north-east we crossed a second grassy stringybark ridge with red soil, and after heading a valley on the left struck a wall of scrub, which forced us for a quarter of a mile to the north-west.

For a quarter of a mile to the north-north-east we kept the crown of a sandstone ridge, and in half-a-mile to the north-east we dropped down to a gully running west, fringed by a scrub which had to be cut.

For two miles to the north-east we kept the crown of a dry stony ridge, three or four hundred feet high, till we reached a gully falling to the east. Here one of Crosbie's horses ("Pluto") had to be left behind. It was, however, brought on next morning, and reached Somerset alive.

In three miles to the north-east, and half-a-mile to north-north, along stony red-soil ridges, well grassed, and timbered with stringybark and Moreton Bay ash, we reached a bog and camped. [Camp 70.]

The day's travelling was, for the most part, on the very divide of the Peninsula.

When we had camped, I crossed the bog, and found that it fringed a creek of the third magnitude, running to east-north-east. The creek in all probability falls into the estuary of the Kennedy. It was beyond my depth, and it was difficult to reach it by the bog. I attempted to reach the creek half-a-mile further down, but was baffled by the dense growth of reeds in deep still water, over a breadth of nearly a quarter of a mile.

March 30.—The whole day was consumed in crossing the bog, which we crossed after travelling for a mile to east-north-east on a good grassy, well-timbered ridge. Where we crossed, the creek ran east. It was deep and wide, but had a sound bottom. Tributary bogs came in from the north. We next crossed bogs and heath for nearly a mile to east, north-east, and west. At the last bog we had very serious difficulties. The packs had to be carried about a quarter of a mile across water and rushes, knee-deep, the horses standing almost up to their bellies all the time. Rain came on in the middle of the operation. Had it continued an hour, men and horses would probably have been swept down into Newcastle Bay. Several of the horses got bogged on being led across with empty saddles. But for the assistance of the prospectors, "Olive" would never have reached dry land.

We camped on the edge of a scrub bordering a branch of the swamp. [Camp 71.]

More rain fell after we got into camp.

March

March 31.—The night and day were fine.

After two miles of travelling to east-north-east, over red-soil ridges, occasionally stony, but well grassed and timbered, Crosbie climbed a tree and saw the "low-wooded country" (mangroves), marked on the chart, between the estuaries of the Kennedy and Escape Rivers.

Descending into a valley, we kept for half-a-mile to the west-north-west along a belt of scrub, and for half-a-mile in the same direction to another scrub, which proved very dense and had to be cut.

In half-a-mile through scrub, down a gentle slope to the north-west, we reached a wet alluvial flat, with very long grass. Recent cattle-tracks were everywhere about. One well-beaten track led round the head of the alluvial flat. We followed it for about a mile from north-north-west till it turned to south-east, when we left it fully convinced that the track did not lead to Somerset.

In half-a-mile to east-north-east we reached the right bank of a fourth-magnitude creek connecting a chain of waterholes; on running the creek up for a mile to the north we got hemmed in by scrubs to the left, while the creek to the right was impassable. We came back for half-a-mile to the south and camped. [Camp 72.]

After we had camped I went down to where we had turned off the cattle-tracks and traced them a little further. I found that they crossed the creek within a quarter of a mile by a good crossing. I found also a good crossing with a hard gravelly bottom, a quarter of a mile below the camp. Beside the lower crossing there were signs that natives had recently been feasting on cattle.

There was one heavy shower in the night.

April 1.—On crossing the creek near the camp we discovered two human skeletons which had been exposed among the branches of fallen trees. I carried away the skulls and presented them to Baron Maclay, whom I shortly afterwards met at Thursday Island.

After two miles of zig-zagging, mainly to the east, we caught sight of Turtle Island bearing east 15 degrees south.

In half-a-mile to east-north-east we passed a swamp on the right. In another mile to the north-east we passed the remains of an old stockyard and hut—an out-station on Mr. Jardine's run called "Chenium," about ten miles from Somerset, as we afterwards learned. "Chenium" is situated on the right bank of the creek which we crossed in the morning.

Fully convinced that there must be a recognisable track from the old station to Somerset, we beat about for some time in search of it. After three miles of zig-zag travelling, by cattle-tracks of to-day's date, during which we made about half that distance to the north-east, we reached a swamp and ran to the north along the edge of it for half-a-mile, till we were blocked between the swamp and the scrub. We came back for half-a-mile to the south-west and half-a-mile east-south-east till we were again hemmed in between the bog and the scrub. After some time, however, Crosbie found a track (some years old), leading to the south-west through the scrub. Following the track we emerged on a white ridge of blown sand and got away to the east for a quarter of a mile by the sand-hill, which wound round the south side of the swamp. The scrub, however, closed over the sand-hill. Crosbie started to clear a way, but desisted on finding that there was at least a mile of the scrub.

We came back for half-a-mile to the south and camped on the edge of a lagoon. [Camp 73.]

After we had camped, beginning to comprehend that we might have to reach Somerset by the beach, I made an excursion to the south-east in the hope of finding a clear way, but in half-a-mile was stopped by the closing in of the scrub.

The day was fine and warm.

April 2.—While the horses were being mustered in the morning I went back to where I had left off yesterday afternoon and penetrated for a quarter of a mile further through heathy scrub on sand ridges, and saw from a tree similar scrub extending for half-a-mile further, but could not see the sea.

Crosbie followed the creek at "Chenium" up to the north for some distance. We resolved to make one more attempt to reach Somerset by this route.

Some of the horses had strayed, and we made a late start.

Two miles to the west of the camp we passed the old station on the left, and followed the creek up by cattle-tracks, which sometimes crossed and sometimes ran in the bed of the creek. In a mile to the north we were hemmed in by a scrub which had followed the left bank of the creek. After skirting the scrub for half-a-mile to the west till we found that we had penetrated to the end of a "pocket," Crosbie and Layland went ahead to look for open country. They penetrated the scrub for about a mile to north, north-east, and east, and got away to the east for about half-a-mile through open country. When they returned it was too late in the day to cut the scrub for the questionable advantage of getting away for half-a-mile to the east. We followed the creek down (two miles) and camped at Chenium. [Camp 74.]

Our flour having been exhausted to-night, I should have pushed on for Somerset on foot to-morrow, but that the prospectors had a surplus and were kind enough to share it with us. They gave us seven pannikins, which provided us with subsistence for a day and a-half.

April 3.—Resolved to cut our way down to the beach, we left Camp 74, and passing the site of Camp 73, kept for half-a-mile down the pocket to the south-east and a quarter of a mile through the scrub in the same direction, when we passed a swamp on the left. In a quarter of a mile to the east we emerged from the scrub, and crossed a fourth-magnitude creek running to the south-east, probably the outlet of the bog to the north-east of Chenium.

In a quarter of a mile east through open country we reached a bog with mangroves on its further side. When we had run the bog up for a mile to the north-east, we had to cross from the right to the left bank of a creek of the fourth magnitude, just above the mangroves. We reached the beach in one mile to the east, at a point which bore due west of the black beacon on Z Reef, and about seven miles from Somerset, which we reached about four o'clock. Mr. Frank Jardine made us heartily welcome, and in a few days of good living and cheerful society we forgot the hardships of our tedious journey.

On the 5th of April I left Somerset, accompanied by Love and Charlie, for Thursday Island. The English mail steamer "Bowen" picked us up on the 8th, and we reached Townsville on the 12th. Macdonald was left behind in charge of the horses. The prospectors also stayed till they should receive instructions from Brisbane. The prospectors and Macdonald left Somerset on the 26th by the "Corea," with all the horses.

The

The geological structure of the Cape York Peninsula is exceedingly simple. The backbone or dividing ridge of the peninsula, which lies close to the eastern seaboard, consists almost entirely of granite derived from the metamorphism of slates and greywackes (the equivalents of the auriferous rocks of the Palmer River). This granitic "backbone" rises into lofty mountains in the McIlwraith, Macrossan, Janet, and Carron Ranges. The ranges are generally flanked by little altered rocks.

This high ground has formed the shore of the vast sheet of water in which the "Desert Sandstone" was deposited. In all probability the granite stood up as ranges prior to the deposition of the desert sandstone by virtue of its superior hardness to the surrounding unaltered slate and greywacke rocks. When subsequently a submergence took place, the unaltered rocks, having been previously denuded into lowlands, were covered over by the desert sandstone. To one travelling northward from the Coleman River, the sandstone first appears far to the west, but it gradually steals eastward, lapping round the base of the range till it reached the eastern seaboard at Temple Bay.

The sandstone has a very gentle dip to the west and north, away from the granite—so gentle that there seems no reason to ascribe it to unequal upheaval, since the gradual deepening of the bottom on which the sandstone was deposited, as it receded from the land, is quite sufficient to account for it. This gentle dip coincides, or nearly coincides, with the fall of the ground from the ranges to the Gulf, while the Wilkinson, Gerkie, Sir William Thompson, and Richardson "Ranges" are the eastern escarpments of massive sandstone beds.

The question of the geological age of the desert sandstone, which Daintree justly characterised as "the most recent wide-spread formation in Queensland," is a very puzzling one, and much apparently contradictory evidence has been brought forward on the point. I hope to discuss the whole question shortly in the pages of a scientific journal. At present I shall only state my belief that the formation is homotaxial with the European cretaceous rocks.

There is every reason to believe that the auriferous slates, &c., of the Palmer district are represented in the peninsula further north, and may yet give up their wealth, but they are covered with such a thickness of "desert sandstone" as practically puts them beyond our reach for the present age. The granitic rocks forming the *nuclei* of the ranges, especially of the McIvor Range, are to some extent auriferous, although apparently not sufficiently so to pay for European labour under the present conditions. My impression was that the Coen (or Kendall?) and the Peach could be at least worked with profit by Chinamen. Since the date of our visit to these rivers, however, the Coen has been "rushed" by Chinese, who have returned disappointed, owing, it is said, to the expense of land carriage and the hostility of the blacks; they never reached the Peach.

It is much to be regretted that the Peach was not more exhaustively prospected. The expedition started at the worst possible time of the year. Only a very hurried examination had been made when the floods came and rendered prospecting in the bed of such a river an impossibility. We travelled northward in the hope of finding payable gold elsewhere, and with the intention of trying the Peach again on our return. It turned out, however, that Fair Cape was the northmost point* which offered any promise of auriferous country, and I felt it my duty to represent to the Government that that point could be reached from Cooktown at a less expense in time, money, and horseflesh than by recrossing the desert country which had cost us the lives of so many horses.

The two journeys, whose main incidents have now been related, if they have not added to the material wealth of the colony, have, at least, increased our knowledge of its physical geography, and dispelled much of the mystery which has hitherto enveloped the geology of the Cape York Peninsula.

I cannot close this narrative without referring gratefully to the assistance rendered by all my companions. Perseveringly and steadily they gave their whole energies to the object of their search; and, if they did not succeed in finding payable gold, it was probably for one or other of two good reasons—either it was not there to find, or the floods of the wet season put it beyond their reach.

ROBT. L. JACK.

*Except some very limited areas at Cape York and the islands in Torres Straits.

Price 1*s*. 3*d*.]

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1881.

QUEENSLAND.

GEOLOGICAL SURVEY OF NORTHERN QUEENSLAND.

Presented to both Houses of Parliament by Command.

FURTHER REPORTS ON THE PROGRESS OF THE GOLD-PROSPECTING EXPEDITION IN CAPE YORK PENINSULA.

We arrived last night at the "remarkable red cliffs," noted on the coast chart opposite the Piper Island Lightship, and a boat has come off this morning by which I send this short account of our progress up to this date.

We reached the Peach River in longitude 142 degrees 50 minutes east and latitude 13 degrees 23 minutes south, having found colours in the gullies from the Coen northward to the Peach.

I led the party to strike the Peach so far west for the purpose of seeing a range which had been dimly descried on the previous trip and which, I thought, might possibly be auriferous country. It turned out, however, to be horizontally bedded "desert sandstone," covering over all the possibly auriferous country in that locality.

This "desert sandstone" now appears to occupy a much greater area in the Peninsula than has been hitherto suspected. Covering all the surface west of the 143rd meridian from the Peach River northward to the south corner of Temple Bay, with a very gentle dip to the west, it reduces the primary and possibly auriferous country to a very narrow belt along the east coast.

The prospectors spent ten days on the "upper reaches of the Peach River," so far as these were accessible for scrub and precipitous rocks. To our great disappointment, we found the stream so confined within rocky gorges that scarcely any washdirt was to be found, the force of the current having washed the rocky bed of the river quite bare. Where any wash was found it generally yielded colours.

Having crossed the Coast Range, from the head of the Peach River to the eastern waters, we obtained colours in the gullies opposite No. VIII. Island. Since then we have been travelling northward, across the heads of tributaries of the Peach and down the Pascoe River (which rises near the south end of Lloyd Bay, goes north-westward to the 143rd meridian and north-eastward into Weymouth Bay). We have not obtained even colours, however, from No. VIII. Island to Fair Cape, although country of the same character (granite in the mass of the range, with occasional gneiss, mica schist, and quartzite on its edges) has been traversed.

The rains have made travelling since Christmas very difficult and disagreeable. We had to camp for a week opposite No. VIII. Island, for another week in the latitude of Cape Direction, and, finally, to wait at the Pascoe River till Mr. Crosbie's party built a boat to carry the packs across.

The natives proved very hostile from the heads of the Peach to a camp near Cape Sidmouth (about ten days). They attacked Mr. Crosbie's party once and mine twice while travelling in the rain. They threw spears from ambuscades on the edges of the scrubs, on one occasion wounding fatally the horse I was riding, and on another inflicting a severe flesh wound on James Love's horse. They were, however, so far misled afterwards as to leave their cover and brave us in the open country, when they learned to respect firearms. We have never seen them since till we camped here; they do not even follow our track. There is a small party camped near us here, but we apprehend no danger from them, and we leave to-morrow morning.

We expect to reach Somerset in about a month, finding out by the way whether the Richardson Range is an exception to the sandstone which we fear will prove to be the rule north of this.

On the way back it is my intention to prospect the remaining, possibly, auriferous country—viz., that from the south end of Temple Bay to the south end of Lloyd Bay, which we were unable to reach on account of the rains. I shall also spend some time on the Peach River in its *lower* reaches, where the washdirt must all have been carried. Naturally, more time would have been spent there on our way north if we had known how poor the country to the north was to prove. By the time we return we hope that the question of the value of the Cape York Peninsula as a possible mining country will be settled once for all.

The party is in good health, with the exception of Mr. Macdonald, who has suffered occasionally from attacks of biliousness and fever.

ROBERT L. JACK.

Temple Bay, 16th February, 1880.

REPORT

REPORT No. 2.

Two days after the date of my last report the combined prospecting and geological parties left Temple Bay for the ranges to the west.

Our progress was arrested early on the morning of the 21st February by a large and deep river running to the north-east, and after vain attempts to cross it, finding that we were being carried to the south and even to the east of south by branching tributaries nearly as formidable as the river itself, and that we were in country which had lately been submerged by frightful floods, of which the daily heavy rains threatened a speedy repetition, we camped and built a canoe for the transport of our saddles and packs. This work was accomplished in safety on the 23rd. The horses were swum across with much greater difficulty owing to the strength of the current, the softness of the banks, and the number of trees in the middle of the river. One of the horses of the prospecting party was drowned. This river, which probably empties itself into the north end of Temple Bay, was afterwards found to rise to the north-west, about the latitude of Young Island. It received the name of the Macmillan.

After an arduous day's travelling, mainly in a north-westerly direction, through boggy country, dense brushwood and scrub, without a blade of grass, we camped among the spurs of the range—easy red-soil ridges with open timber. We had the satisfaction of being once more high and dry in a place where the floods could not harm us and where the horses would find plenty to eat. Heavy rain began before we had completed our camp, and the next day—the 25th—brought such torrents that we were convinced that had the crossing of the Macmillan River been postponed for twenty-four hours men and horses must alike have been swept away.

For the greater part of the two following days we kept, on a course of N.N.W., the edge of a sandstone tableland, which dropped off suddenly on our right hand. This portion of the range afforded at least better travelling—on open-timbered, grassy land—than any we had enjoyed north of the latitude of No. VIII. Island of the Claremont group. But our satisfaction on this ground was more than outweighed by our chagrin in finding that the range was composed solely of the "desert sandstone" with which we had already become too familiar in the Peninsula. This sandstone has an almost imperceptible dip to the west, and the escarpments formed by the weathering of the harder beds give rise to the so-called "range" which divides the eastern and western waters of the greater part of the Peninsula. A few miles west of our course lay the crowning escarpment of the range; a lower shelf of the sandstone stretched between us and the sandhills fringing Shelburne Bay; its only vegetation a dreary heath, relieved at intervals by coarse grass on some isolated fragments of the higher shelf on which we were travelling.

On the afternoon of the 27th February we left the tableland and struck due north into the heathy country, when we found a large creek running north-east towards Shelburne Bay. A foot-bridge was improvised by felling an overhanging tea-tree and ekeing it out with saplings and a rope. Over this our packs and saddles were carried on the heads of the party. The horses were got across at a place a quarter of a mile higher, where they could just keep their feet and no more. We camped on the left bank. The rain which fell during the subsequent part of the day and following night made us thankful that we had got over in time.

On the 28th we travelled nearly due north for 11½ miles, over country partly heathy and stony and partly open-timbered (chiefly stringy-bark), with red sandy soil. This brought us about 10 miles north of the camp where the Messrs. Jardine, in 1865, first met with the country which they describe as "frightfully bad" and "fearfully difficult," and we began to flatter ourselves that we were to be more fortunate than they, our course being on the eastern and theirs on the western side of the escarpment of the Richardson Range.

The following day we picked our way for 8½ miles, in torrents of rain, as nearly north as the circumstances permitted, down or across the heads of gullies falling to the north-east. We saw scarcely a blade of grass in the day's stage. To avoid the bogs we had to take to the heathy brushwood, through which a path had to be cut for the horses. We camped on a gully in a little patch of forest country, on very coarse grass—worse than any that our horses had yet met with. (Camp 50.)

Having settled in camp, Mr. Crosbie and I ascended a scrubby sandstone hill to the east of the camp. We found the east side of the hill masked by ridges of blown sand which extended to the coast, a distance of not less than 10 miles. The Macarthur Islands lay due east. To N.N.E. we could see the Richardson Range, its escarpment trending from N.N.E. to S.S.W., and apparently covered with dense black scrub. The intervening country was bleak and wretched in the extreme—bog, heath, and brushwood. It required some courage to face the task of forcing our way through such a land. At our feet lay a dark, circular lake, enclosed among sandhills; its outlet was traceable for some distance to the north and north-west, when it fell into a creek running north-east. Mr. Crosby had seen one native during the day, and from the scrubby hill we made out the smokes of several camp fires among the sandhills.

On 1st March we travelled 9¾ miles, nearly due north. Rain began as we left, and for half the day some of the heaviest showers of the wet season aggravated our difficulties with brushwood, log, and heath. The escarpment of the Richardson Range could sometimes be seen a mile or two to the west. Several small creeks were crossed draining to the east. We camped at nightfall on the first grass we had seen since midday, on a spur of the range (Camp 51). Our route this day probably coincided for the most part with that of the Brothers Jardine.

Hoping to find on the tableland better travelling than on the heathy shelf below, we sidled up the hills on the morning of the 2nd March. We were cruelly disappointed, as it turned out a day of severe toil. We had no sooner reached the top of the tableland than we had to begin cutting our way through dense scrub (cypress pine and vine), and this continued, with little intermission, for the remainder of the day, the exceptions being narrow steep-banked boggy creeks, one of which had to be bridged over. A heavy rain fell for the greater part of the day. The course was mainly north, and the distance travelled about ten miles. Early in the day, one of the horses ("Greenhide") showed symptoms of weakness, and blundered into a gully, from which he was extricated with difficulty. The rain fell during the greater part of the day. One small creek, about four miles north of Camp 51, ran eastward. The creeks crossed further north made their way to the north-west, doubtless to join the

Jardine River or its large tributory, the McHenry. We camped at nightfall on the edge of a scrub, in which a gully was found containing a little water. This scrub was afterwards found to fringe a gully running to the N.N.W., which we had reason to believe was the very head of the Jardine (Camp 52).

It was so nearly dark on our arrival in camp that we could only observe that the grass was coarse; but it *was* grass, and the first that we had seen for some time, the last few miles having been barren heathy country. When the morning broke (3rd March), the first glance at our surroundings suggested the thought that we should have much trouble in mustering the horses; and this surmise proved strictly correct. The last of Mr. Crosbie's horses was found by 2 o'clock, and the prospecting party pushed on in the hope of at least reaching a camp where the horses could live. One valuable mare—"Olive,"—the recognised leader of the pack-horses, was still missing. We continued the search for two hours longer, still without success, and then followed the track of the prospecting party, resolved to return to seek the lost mare if we could find a camp, in the meantime, where the other horses would stay. The supposed head of the Jardine was run down to the N.N.W. for about two miles, when we crossed to the right bank. The whole day's journey was only about 2¾ miles, the prospectors having had to hew their way through dense vine scrub. After we had joined them, night overtook us in a narrow pocket, cumbered with a thick undergrowth of shrubs, and bearing only the coarsest and rankest grass. In spite of the rain, which had fallen heavily at intervals while we were travelling, water for the billy had to be carried from a gully half-a-mile back on the lane which had been cut through the scrub. I pushed on about a mile to the north by the compass, but found no end to the scrub, while Messrs. Crosbie and Leyland penetrated as far to the N.N.W., but found only a pocket similar to that in which we had to camp.

The condition of the horses had become very critical. They had had next to no grass the previous night. They could have none to-night; and I suspected the presence of poisonous plants among grass such as was to be found here. Should the horses wander into the scrub it might take days to find them. Another day's work, followed by a failure to find grass, would relieve us of all further anxiety regarding the horses, the strength of the poor beasts having already been greatly reduced by rain and flies. In the circumstances I judged it best to tie the horses up for the night (with the exception of the four weakest—viz., "Queensland," "Greenhide," "Billy," and "Greyhound"), and to make, on the following day, a forced march back to the last grass that we knew of (at Camp 51), and thence resume the search for the mare while recruiting the other horses. As this plan would necessarily involve at least a temporary separation from the prospecting party, I made for Mr. Crosby's use a copy of the map between our camp and Somerset. Mr. Crosby's plan was to make north for the "grassy flats," about 10 miles distant, marked on the chart to the west of Pudding Pan Hill, and wait there a few days to recruit his horses. There we might rejoin him, or at least pick up his tracks. It may be mentioned here that after satisfying himself of the non-existence of the "grassy flats" in question he made for the coast near False Orford Ness, where we rejoined him on the 10th March.

We started early on March 4th and reached our old camp, 51, an hour before dusk. Charlie detected the tracks of blackfellows on ours near the camp. Rain fell heavily for the first three or four hours after we made a start. The day proved a very disastrous one. Of the four weak horses which I had allowed to feed, out of sheer pity, the previous night, two—"Greenhide" and "Queensland"—had to be left behind, being unable to stand, although frequently hoisted on their feet; a third—"Greyhound"—barely managed to crawl to the camp. All three had evidently been poisoned, and I was painfully conscious that they had no strength to come and go on.

Heavy rain fell from daybreak till 10 o'clock of the 5th March. Macdonald and Charlie succeeded in tracking the strayed mare, and drove "Queensland" and "Greenhide" a short distance towards the camp. As the morning's rain was succeeded by a sultry afternoon, I seized the opportunity of drying provisions, clothing, bedding, ammunition, saddlery, &c., all of which by this time stood sorely in need of attention. I also spent some time on the edge of the tableland, anxiously spying out the nearest and clearest access to the coast, having satisfied myself that the inland route was unprofitable, if not impracticable. I had also the painful task of deciding which of our impedimenta we could best spare, as it had become absolutely necessary to lighten the loads of the remaining horses.

We left Camp 51 the following morning, and had very heavy rain till two o'clock. We followed our previous northerly track for two miles, and left it at the point where we had ascended to the tableland, steering for a distant point of the hills, whence I thought I had seen a comparatively clear way to the coast. We found one way barred, however, by an impenetrable scrub; and as the third poisoned horse ("Greyhound") seemed still unable to travel, we camped early (Camp 55). When the rain had cleared up in the afternoon, I went to the point we had been making for in the morning, and found that it could be reached by easy travelling on the eastern edge of the tableland.

March 7th was a dull and threatening day, but there was only one heavy shower. I made a last attempt to save the two horses abandoned on the 4th. "Greenhide" was found in a dying condition, quite idiotic, worn to a skeleton, and his skin a network of sores. "Queensland" seemed better, and I left him on a grassy plot where we could pick him up on the way—an arrangement which would save him two miles of travelling on the next stage.

On 8th March we left Camp 55 and got along comfortably to where "Queensland" had been left. The unfortunate animal had died during the night.

A mile and a-half to the east, through rather thick "whipstick" brush, brought us to a small creek running south-east. A bit of scrub had to be cut, and the crossing had to be improved a little. Poor "Greyhound" stumbled in getting up out of the water, and, although lifted out, was too weak to stand, and fell back helpless. We were under the necessity of leaving him to his fate. The last watch in the party had succumbed on this date to the incessant damp, and we were for the rest of the journey without means of estimating the distance travelled, except by a rough guess. The cloudy sky seldom permitted me to get our position by the stars. Our finger and toe nails had become so softened, almost to the consistency of cheese, from being constantly wet. The snider and shot-gun ammunition had absorbed moisture to the degree of being unreliable in any emergency. My Westley-Richards rifle, with its protected lock and metallic cartridges, could be used in any circumstances.

In the afternoon we camped on fine grass about a quarter of a mile from the sea. Before coming into camp the black boy's fine eyes detected a native, who was looking for sugar-bag. He invited me to shoot him. This would have been easy enough; but I declined the sport, to Charlie's great mortification.

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On the morning of the 9th, as we were packing up, a number of natives came forward, holding up their hands and shouting "Whitefellow!" Two of them were permitted to parley outside the camp. They spoke English well, especially one who called himself "Billy" and said he was captain of many canoes. Billy said he had been with bêche-de-mer fishers, and displayed an intimate acquaintance with their ways. He offered to bring us fish. The last of our beef had been eaten more than a month before, and fish would have been a welcome addition to our rations. We accepted the offer, and bargained to exchange tobacco for the fish, but insisted that only two were to come to traffic and that they should leave their spears behind.

Billy walked beside us for about a mile and a-half to the mouth of a creek, showing us the track down the cliffs to the sandy beach. In the mouth of the creek a large canoe was moored. The place bore W. 5 degrees S. from the northmost of the Hannibal Islands. In conversation with "Captain Billy" regarding his experience among whitefellows, Love asked if he had ever seen white women. Billy replied in the affirmative, but in terms so gross that the *ipsissima verba* were not reported to me till nearly a month had elapsed. On being pressed as to where and how he had seen the white woman or women, he lapsed into sulky silence. At first I merely inferred that Billy had seen women at some fishing station, but I now strongly suspect that he knows something of the white woman seen by Captain Pearn at Cape Grenville about two years ago, and for whom an unsuccessful search was shortly afterwards made. In connection with this subject I may here refer to a discovery which seemed of no importance at the time, but which may now be regarded in a new light. Mr. Crosbie and I found, on the 16th February, about half-a-mile south of Bolt Head, in Temple Bay, the wreck of a large brig, of colonial build (according to Mr. Hamil, of the prospecting party), sheathed with copper and muntz metal, with its cargo of cedar logs strewn on the beach beside it. Most of the timber bore the brand L, and some of it DH. Our guesses at the age of the wreck varied from three to eight years. When we met the master of the Piper Island lightship, three miles further north, we inquired about the wreck, and his reply, that he had never heard of it although the lightship had been there for four years, confirmed my opinion that the wreck was at least over four years old. That it was a wreck whose whereabouts nobody knew never occurred to me till I had made further inquiries at Somerset and Thursday Island. The question arises—What has become of the crew? A woman may possibly have been on board, and may have escaped the massacre which doubtless awaited her companions.

Having crossed the mouth of the creek where the canoe was moored, and another similar creek three-quarters of a mile further north—the packs just touching the water in both cases—we ascended a bare sandstone headland. Here we detected two blacks—one a hunchback—planted in the long grass, with their spears beside them. Four or five were also seen behind us with spears. Five or six more were seen paddling a large canoe rapidly towards us. I was strongly inclined to think that we were the objects of a pre-arranged attack. As it was, we had the blacks at our mercy, for it would have been easy to have shot the two men discovered in ambush and to have emptied the canoes from our vantage-ground on the top of the cliffs; but I forbore, anxious to avoid a quarrel if possible. Having warned and threatened the two spearmen, we continued our journey. Billy presently overtook us, and said that he knew the men in the boat, who were "all very good," and that they would probably have fish if we waited for them. We declined to wait.

When we had got down once more to the beach, Billy brought up some of the canoe's men. The offer to bring fish for tobacco was renewed, and we sent the men off, insisting that only two were to come and without spears. For the next six or seven miles we saw nothing of the blacks, and we were considering the suitableness of a rocky headland with a little grass for a camp when five natives were seen on our track with spears. We took our firearms and advanced to meet them: four dropped their weapons, which were not fish spears; a fifth carried his with him to the scrubby sandhills; three stayed to meet us. They pretended that the spears were only meant for fishing, but we knew better. They offered us one small fish, which we refused. We let them clearly understand this time that we should fire on them if they appeared again on any pretext.

I may have been in error in letting the treacherous savages go, but shooting a naked and disarmed man, however justifiable the act may be, is painfully suggestive of murder to my mind.

We continued to travel northward by the beach towards a grassy flat two miles distant. The blacks were now coming on behind, at least fifteen in number, carrying spears, and making no disguise of their intention of falling upon us whenever they could get us at a disadvantage. It only remained for us to choose a place where the advantage of the ground would be on our side to turn on them. A broad part of the beach (11 degrees 29 minutes south latitude) seemed to offer such a vantage ground, as our flank could not be attacked from under cover of the scrubby sandhills. We found, however, that a large creek with treacherous muddy bottom lay between us and the broad patch of sand. The horses got through with difficulty, and my belief is that the savages were waiting to see us thrown into confusion at this place. On the left bank we dismounted, and fired on the natives, who had begun to run. I believe we did no damage, but we saw no more of the blacks for the rest of the day.

We camped here (Camp 57) on a grassy flat separated from a scrub by a deep lagoon—a backwater of this creek. The camp bore west 33 degrees south from Halfway Island, north-west from the outer Hannibal Island, and west 4 degrees north, the eastmost islet in the Boydong Cays group.

I arranged that the night was to be divided into four watches by the stars. Macdonald had finished the first, and I the second; Love, who had been sleeping in the same tent with me, had been on guard for about twenty minutes (about half-past one o'clock), and was rounding up the horses about 200 yards from the camp, when suddenly I felt a spear crash through my neck a little above the shoulder-blade. To reach me it must have passed over the space where Love had been sleeping, till he was roused to take his watch. I sat up, and was in the act of reaching for my revolver, when a second spear pinned the canvas stretcher from which I had just lifted my head. I fired a shot and called on all hands to turn out. Macdonald alone responded, the watch being engaged as already mentioned, and Charlie having heard the blacks getting into the creek had taken to flight. Charlie was met by Love, who naturally took him for one of our assailants, and brought him to a standstill (unhurt) by two revolver shots.

I attempted to pull out the spear, which was about eight feet in length, and the thickest I have ever seen, being nearly an inch in diameter. Its barb (which I have preserved) was of quarter-inch iron, seven inches long; and the thickest part of the spear, about six inches beyond the barb, was tightly fixed

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in my flesh. Not knowing whether or not we were to have the satisfaction of seeing our enemies face to face, and resolved to bear my part in their reception if they should come, after hastily satisfying myself that no important blood-vessel was involved in the wound, I carried the sheath knife to Macdonald and ordered him to set me free by cutting into the spear through the flesh. To cut the spear, which was of very hard wood, might have taken a few minutes of time, and the integrity of a little bit of flesh might have been very dearly purchased had the blacks resolutely followed up their attack. After the rough surgical operation, I felt rather faint for a few seconds.

Random shots were fired across the lagoon into the scrub at intervals during the night. The tents were struck at once, and I lay down in the open air, while the rest, including the reclaimed and repentant Charlie, kept vigilant watch. About an hour after the attack, two blacks were seen crossing a bare patch of sand, and attracted a volley, but probably they suffered no damage. Four spears were found in the tent which had been occupied by Macdonald and Charlie. One had gone clean through a bag of rice, made a hole in a tin case protecting a bottle of oil, and smashed the bottle. The whole collection of spears was broken up and burned.

For some time the wound was very painful. My head had to be laid down for me when I went to rest, and lifted for me when I wished to get up, and I had to be lifted into the saddle. The shock to the nervous system was greater than I could have believed a healthy man would have suffered from what was after all only a flesh wound.

It would have been quite impracticable for us to follow the blacks in the condition in which our horses now were, even had we been more numerous. As they had followed us nearly ten miles, they probably returned to their camps for food in the morning. They could easily elude us by going out to the islands in their canoes.

The next morning, 10th March, we travelled to False Orford Ness by the beach, a distance of eight miles. About half-way to the Ness we had to wait three hours for the falling of the tide before we could cross the mouth of a small creek. At False Orford Ness we found the prospecting party, and gladly camped beside them (Camp 58). Mr. Crosbie poulticed and dressed the wound, and I am deeply indebted to the whole party for numberless acts of thoughtful kindness.

The prospectors had been less fortunate than we in making the coast. They had had more rain, and an incessant struggle with scrub, heath, and bog. Mr. Crosbie was suffering martyrdom from ear-ache. The horses had suffered dreadfully from want of grass. Three were lost in consequence of the poison they had eaten at Camp 53.

ROBERT L. JACK.

Townsville, 14th April, 1880.

REPORT No. 3.

False Orford Ness is an untimbered promontory of horizontal ferruginous red sandstone, terminating in a cliff of about fifty feet in height. The sandstone is covered, lightly near the sea, with blown sand, which rises further inland into high sand-hills. The prospecting and geological parties spent two days more in recruiting their horses on the good grass and succulent "pig's-face" of the coast.

On 13th March we travelled by the beach from False Orford Ness to the Red Cliffs, in 11 degrees 30 minutes south latitude. Between False Orford Ness and Orford Ness proper low points of sandstone come down at intervals to the sea, but generally the hills of blown sand begin at high tide mark and extend for miles inland. Blacks were seen following on our track at a cautious distance.

In the south bend of Orford Bay we found a large saltwater creek with four mouths, among mangroves. The eastmost mouth had a thin and treacherous crust of sand on stiff black clay. Some of the horses were badly bogged, one of them wetting all my maps and papers. Invisible blacks were hallooing among the mangroves while we were engaged in extracting the horses from the mud. At the next mouth we had to wait for about an hour till the tide, which had been falling for about an hour previously, had fallen low enough to allow us to cross. About a mile beyond the last mouth we saw seven or eight blacks who had recently landed from a large canoe, and met their gins carrying their luggage overland. Both parties retired into the sand-hills on our approach.

Orford Bay has a broad stretch of sandy beach, bordered with low sand-hills which extend a long way inland. We camped on the (low) Red Cliffs of sandstone marked on the chart in latitude 11 degrees 14 minutes south.

Next day (14th March), as precipitous cliffs frequently overhung the sea, we had to travel for the most part on the sandstone ledge. Some thick scrubs had to be cut, behind the first tier of sand-hills at the back of the Remarkable Red Cliffs. From this point northward to Turtle Reef the sandstone is mostly replaced by a coarse pisolitic rock of sandy brown hæmatite. We camped about a mile south of No. II. Point. The next day gales and heavy rain made it impossible to move th camp.

We found good travelling on the 16th March, on the top of high cliffs of sandstone and pisolite, as far as the bay south of Flat Hill, where we had to wait two hours for the fall of the tide at the mouth of a large creek skirted by mangroves. We camped at night opposite an uncharted island, on a point bearing south 26 degrees west from the south-east end of Fern Island.

It had now become necessary to leave the coast and strike for the valley of the Jardine River with the view of heading the Escape and Kennedy. The horses were indulged with one day's spell before starting. Mr. Crosbie walked to Shadwell Point and saw the Albany Pass. Our camp lay about 22 miles from Somerset, and yet we had to make a journey of 117 miles before we could reach that haven.

On the 18th we struck inland. The first four miles led us west-north-west by soft red-soiled ridges well timbered with bloodwood, box, and stringybark, and well grassed. Then a ridge of white sand, with a scrub to the left and a lagoon to the right, carried us a mile to the north-west. For two miles further (west 10 degrees north) we had low forest country, with narrow belts of scrub, till we came, to our chagrin, on a small saltwater creek, a branch of the Escape, which we had hoped to head. We had to run the mangrove swamp up for a mile to the south-east, when the saltwater creek was replaced by a

deep

deep and narrow freshwater stream, to whose left bank we crossed. Shortly afterwards a narrow gully had to be substantially bridged with saplings, but one of the prospectors' horses got off the bridge, and lightened his burden by dissolving a large quantity of sugar, besides damaging cartridges, clothes, &c.

After three miles (west 10 degrees south) of well-grassed forest land, we were again arrested by a mangrove swamp. Mr. Crosbie penetrated this belt of mangroves with much difficulty, and saw the main Escape River, half-a-mile in width, with no perceptible current.

Keeping the mangroves in sight, we ran the inlet up on the following day. In two miles (south 10 degrees east) we saw the last of the mangroves, and got among the freshwater heads of the Escape. One narrow creek, flanked by a pitcher-plant swamp, forced us a mile and a-half to the east before we could cross. Rain began here, and continued to fall in torrents for the rest of the day.

We kept the former course (south, 10 degrees east) by scrub-capped stony ridges intersected with pitcher-plant swamps, till we again came on the Escape River, here running north-north-west. Having followed it up for half-a-mile through scrub and brushwood, it bifurcated, and a narrow branch, not fordable, carried us, through bog and heath, to the north-north-east. After half-a-mile on this course, we made for the nearest grass and camped. For two days, in trying to make to the west, we had only succeeded in describing a horse-shoe bend, and it appeared likely that the flooded branches of the Escape would force us almost to complete the circle back to our starting point on the beach.

Next day Mr. Crosbie found practicable crossings of the two branches of the Escape, and got away for about two miles west, through low heathy country, without meeting further obstacles. Heavy rain began to fall, and it was too late to make a start when Mr. Crosbie returned.

Following Mr. Crosbie's tracks of the previous day, we crossed the two branches of the Escape, the packs having to be carried over the larger branch on a bridge of saplings, while the horses were crossed (just afloat) a quarter of a mile above. After two miles to the west, mostly over bog and heath, we came to another branch of the Escape, falling north. We ran this creek up to its head in about three miles. For the first half-mile a thick scrub had to be cut. Two miles further to the south-west, across the crown of the divide, when we were certain that we were at last on the Jardine fall, we camped on the edge of a swamp.

On 22nd March we started to run the Jardine valley down till we should be clear of the Kennedy River or saltwater inlet. Early in the day the black boy detected cattle tracks and dung only a few months old. We kept the Jardine side of the divide, which is generally scrubby, and steeper on the eastern than on the western fall. We accomplished $8\frac{1}{2}$ miles, for the most part in a west-north-west direction, without meeting any creeks of importance. The next day we did not move, as there was heavy rain in the morning, and two of the prospectors' horses were on the point of succumbing to the effects of the poison they had eaten on the Richardson Range. My own riding-horse (Poodle) had been weak since we came down to the beach on 9th March.

On 24th March we ran west 10 degrees north for six miles; the first three miles through closely timbered grassy country, just below the scrubby divide, the second through heath and wire-grass with pitcher-plant swamps, falling to the south. One of the latter forced us two miles to the north before we could cross it. Here all uncertainty as to Poodle's fate was put an end to. He was not expected to live for more than two days longer, and I had only been riding him occasionally for some time back. At the swamp I rode for a short stage. Resting my wounded arm on the stock of the Westley-Richards rifle which was carried on the saddle, my hand accidentally touched the trigger. The piece must have been cocked just before, while I was leading the horse through the brushwood. The bullet shattered the jaw of the unfortunate animal. As he had hardly had a chance of reaching Somerset alive, even before the accident, his misery was ended by a second shot. One of Mr. Crosbie's horses, poisoned on the Richardson Range, had also to be left here.

In five miles more (west 10 degrees south), through poor wire-grass country, with casuarinas, we found better grass, and a boggy gully falling to the south-west, and camped.

The next day we did not move as the horses had strayed, some not being found till three o'clock. Rain fell heavily from an hour before daybreak till two in the afternoon.

On 26th March we shaped our course a little north of west. For the first four miles we were on the Jardine side of the divide, but imperceptibly crossed it; and after running north for three-quarters of a mile down the right bank of a narrow but deep creek, we crossed a tributary gully coming from the east, and ran the united stream down three-quarters of a mile to the west, still uncertain whether we were on the Jardine or the Kennedy waters.

In a mile and a-half further to the north-west, over closely timbered and fairly grassed country, Mr. Crosbie climbed a high tree, and saw the mangroves of the Kennedy within half-a-mile to the north. We therefore altered our course to the south-west, and had travelled about three-quarters of a mile when we came to a swamp fringing a deep canal-like creek running north-north-east, which it was thought we should have to bridge; and we camped. Luckily, however, a practicable crossing was found about half-a-mile below the camp, on a sandstone bar. The mangroves began to appear shortly below the crossing. The brackish water ran about 40 feet wide and 1 foot deep.

Next morning we crossed the creek, and another similar one was found in the same valley, but was crossed with ease. Believing we had crossed the head of the Kennedy, we struck north-west for a mile, on a stringybark ridge, with a swamp on the left hand draining into the creek we had last crossed. Keeping on the same course, we were surprised to find the swamp beginning to fall, without any perceptible divide, towards a brackish stream, which ran, fringed with mangroves, sluggishly to the west.

Mr. Crosbie and I, leaving the party behind, advanced about a mile further to the north-west, when we found the main Kennedy River. We struck it at a reach which seemed about a mile long from east to west. The mangroves made it very difficult to approach the river, which was about a quarter of a mile in width.

We had now only one course before us, to run the Kennedy up without going too near it. Our course was again south-west, although our goal lay to the north-east. A mile of anxious travelling took us across the swamp, without mishap, to a stringybark ridge. In three miles more (south-west) we came to a narrow flooded creek with boggy banks, and pitcher plant and pandanus. We ran it down for a mile and a-half to west and west-north-west, when the grass gave place to heath, and we came back for half-a-mile and camped. About a mile below the camp the creek was found to turn to the north-east. A few sea-shells were seen in a native camp, from which we concluded that we were not far from the head of the tide

tide. The creek would be fordable here provided it should fall a little in the night; but that seemed hardly probable, as there had been rain for the greater part of the day.

March 28th.—The prospectors' horses had again scattered, and were not found till near midday. The crossing we had had in view the previous night was found impracticable, as the creek had risen. Mr. Crosbie succeeded in finding another. While the horses were being sought for, he and I crossed the creek and went ahead about a mile to west-north-west. On the way back he stopped to improve the crossing, when a very heavy shower came on and in a few minutes swelled the creek to such an extent that the ford was no longer available. When the horses were at length brought up all hands set to work, and we had crossed the creek by a substantial log bridge in less than two hours. With the exception of two boggy gullies crossed later in the day, this creek turned out to be the last of the Kennedy waters which lay on our course. In five miles to the west-north-west, just at sunset, we crossed a sheet of water running to the west, nearly a quarter of a mile wide and two feet deep. Fortunately it had a sound bottom, and we found grass on the north side, after having seen nothing but heath for the last two miles.

March 29th.—Our supply of flour is visibly coming to an end. Including to-day's, we have five days' rations of $1\frac{1}{4}$ lbs. for four men.

We travelled $11\frac{1}{2}$ miles to-day, mainly north-north-east, on grassy ridges timbered with stringy-bark, and occasionally scrubby. The country was composed of ferruginous sandstone, giving rise to a red soil. We reached an elevation of about 400 feet above the sea-level, and were evidently for the greater part of the day following the divide of the peninsula. We camped at sundown on the south side of a swamp.

It took the whole of the 30th to cross the swamp. A strong stream was running to the east. Having run it down for a mile, a crossing-place was found; but our difficulties were only beginning. A network of tributary swamps still lay between us and the solid land. In one swamp the horses had to be left for over an hour nearly up to their girths in water, while the packs were carried for a quarter of a mile across stagnant water and rushes knee-deep. Rain came on in the middle of this operation, but did not continue long. If it had, we should have been fortunate indeed had we managed to reach Newcastle Bay on a raft. Several of the horses got bogged in crab-holes, on being led over with empty saddles. But for the timely assistance of Mr. Crosbie's party, the mare lost on the Richardson Range, and recovered with so much difficulty, would have stuck fast for the last time. We camped on a grassy ridge on the northern edge of the bog, about a mile from our last camp; both horses and men more fatigued than they would have been by twenty miles of ordinary travelling.

March 31st.—We thought ourselves at length in a position to make straight for Somerset, as we were not aware of any further difficulties in our way. After travelling two miles east-north-east over sound red-soil ridges, well grassed and timbered but occasionally stony, we descended into a valley, and were forced to west-north-west for a mile by belts of scrub, and had finally to cut through half-a-mile of dense scrub on a north-west course. On emerging from the scrub we found a marshy alluvial flat, with a well-beaten cattle track. We followed the latter for nearly a mile, on a horse-shoe bend from north-north-west to north, east, and south-east, till we arrived at a chain of lagoons connected by a narrow stream running south-south-east. We ran this up, without finding a crossing, for about a mile, when, getting hemmed in between a scrub and bog, we came back half-a-mile and camped in a grassy pocket.

A ford was found near the camp, and we crossed on the morning of 1st April, and got away for three miles to the east, zig-zagging by cattle tracks, among ridges with brigalow scrub. We found two native skeletons exposed among the limbs of fallen trees, one on each side of the creek, together with evidence that a corroboree on a very large scale had been held in honour of the deceased.

In half-a-mile further to the east-north-east we passed a swamp to the right; and in a mile further (north-east) the remains of an old stockyard and hut beside a swampy creek, called in the native language *Chenium* (Pandanus). A mile and a-half to the north-east brought us to a swamp which we could neither cross nor get round. We tried it to right and left, but were stopped both ways by a scrub on the one hand and the swamp on the other. The east end of the swamp abutted on scrubby hills of blown sand. We were obliged to camp in the evening on a lagoon among the sand-hills, about a mile east of Chenium Stockyard. (Camp 73.)

2nd April.—Some of the horses had strayed in the night, and a late start was made. The whole day was consumed in a fruitless attempt to clear the swamp which had baffled us yesterday, by cutting through or rounding the scrub to the west. We returned to Chenium Stockyard and camped. Our flour being exhausted, we borrowed 7 lbs. more from the prospectors—rations for a day and a-half.

3rd April.—As we were now far enough north to be clear of the Kennedy and all its branches, and had not found an inland path to Somerset, we resolved to cut our way down to the east coast. Starting from Camp 73, we found open country for about half-a-mile to south-east. Half-a-mile further to the east, hewing our way through the scrub on the sand-hills, we emerged on a bog, whose further side was skirted with mangroves. The bog had to be run up for about a mile north-east, when we crossed to the left bank of a narrow creek just above the mangroves. Another mile east, through scrub and heath, brought us to the beach at a point bearing due west from the beacon on the Z Reef, about seven miles from Somerset. About 4 p.m. we reached Somerset, and were hospitably welcomed by Mr. Jardine.

Our difficulties were at an end. Our hopes of enriching the colony by finding a payable goldfield in the northern part of the peninsula had, unhappily, ended long before. A small portion of the peninsula, which the severity of the wet season rendered inaccessible for the time being, still remains to be explored. Mr. Donald Lang, who led a private prospecting party into the peninsula in November last, and who has just returned to Cooktown worn out and ill, entertains hopes of Sefton Creek, the northmost point reached by him (about 13 degrees 10 minutes south latitude). Mr. Sefton and a party of the Coen pioneers prospected on this creek about two years ago, with but limited success. I meant to examine it on the way back, had I returned overland; but, taking into consideration what I have since learned of the sterility of the country between Sefton Creek and Somerset, I have no hesitation in deciding that it can be reached much better by making a fresh start from Cooktown—an economy in time, money, and horseflesh.

A detailed account of the geological results of the expedition is in preparation, and will be accompanied by a map in which the geography of the peninsula will be brought up to date.

Brisbane, 24th April, 1880.

ROBERT L. JACK.

REPORT

REPORT ON THE WILD RIVER TIN MINES.

In the course of my survey of the Hodgkinson district, I last week paid a hasty visit to the Wild River Tin Mines, and I now beg to lay before you the following Report:—

The accompanying map shows the position of the Wild River and the township of Herberton with reference to the camps on the Hodgkinson River. During my stay at Herberton the nights were unfortunately too cloudy to permit of any observations being made to determine the latitude of the place. From observations made at Thornborough, however, and my plotted route, I should in the meantime assign to Herberton a latitude of about 17 degrees 19 minutes S.

The Wild River is the head, or one of the principal heads, of the Herbert.

The dray road from the Hodgkinson to Cardwell, *viâ* the Walsh Valley, passes within a few miles of Herberton, and a branch track to Herberton has been marked out, and is now a good deal used. The distance from Thornborough to Herberton by this road is about 45 miles. I travelled, however, by a more circuitous route, having to pick up pack-horses at Mr. Macdonald's station on the Mitchell.

By the packers' track to Port Douglas, twelve miles across bare slate and sandstone ridges, in a general N.N.E. direction, brought us to "Sam, the Roman's" public house. Five miles more in the same direction took us, after a considerable ascent through a gap in the conspicuous barren stony range known as "The Granite." This range crossed, the track keeps near the banks of Anderson's Creek in an E.N.E. direction, and in six miles more the Mitchell is crossed near the station—its fertile valley presenting a striking contrast to the slate and granite ranges among which the river takes its rise.

Leaving the road here, and keeping an easterly course up the valley of the Mitchell, occasionally touching low slaty ridges, we cross in six miles the dray road from Port Douglas to the Hodgkinson. In two miles more we strike the new dray track from Port Douglas to the tin mines, which is followed for the rest of the journey. In five miles to the S.S.E. the road strikes the Barron River at a ruinous hut and stockyard. The Barron here is about ten yards wide, with a strong and deep stream of water. For five miles (south) the road keeps up the left bank of the river, crossing, at two miles, the road from Cairns to the Hodgkinson. In two miles further (south) a large tributary of the Barron is crossed (Abbott Creek), and the road keeps steadily in a S.S.E. direction for twenty-two miles, when the ascent of the granite range begins. From the crossing of Abbott Creek to the foot of the range, a basaltic formation is traversed—obviously in the form of sheets of lava laid down in the valley of the Barron on an uneven surface of granite or slate. In one place on the east side of the road a copious spring of clear water marks the junction of the basalt and the underlying granite.

As is almost always the case, the decomposition of the basalt gives rise to a red or black soil, which bears fair grass and well-grown timber (box, poplar-gum, and bloodwood in the low ground, with an admixture of *Cycas media* and stringybark on the ridges near the range), and is very good indeed on alluvial bottoms. At the distance of 18½ miles from the crossing of Abbott's Creek, the road passes for 2½ miles through a dense tropical scrub—one of the most luxuriant masses of vegetation I have ever seen. The scrub contains a good deal of cedar, and the dreaded "stinging tree" is very common.

The new road, so far as I travelled by it, is in excellent order, although it must be boggy in parts in rainy weather. The gradients are very easy up to the foot of the range, where in about a mile and a half a rise of about 800 feet is made. A descent of about half as much in the next five miles to the S.S.W. on the other side of the range brings us to the township of Herberton on the Wild River, the site of the new industry.

This neighbourhood was described by Mulligan as stanniferous, as much as six years ago, but as there was then no nearer port than Cooktown, the expense of land carriage would, of course, have rendered the working of tin unremunerative. The harbours of Cairns and Port Douglas having, however, at length been opened, and the basaltic regions in the valleys of the Herbert and Barron having been taken up in squatting runs, attention was again directed to the tin deposits. Mr. Atherton, of Emerald End, on the Barron, having found stream and surface tin in sufficient quantities to warrant further prospecting, took up John Newell and seven others from Tinaroo (about 30 miles off) to the heads of the Wild River in the latter end of 1879. This party found stream tin in payable quantities in Prospectors' Gully on the left bank of the Wild River near the present township of Herberton. Four months later, William Jack and party explored the neighbourhood of Prospectors' Gully, and were rewarded by the discovery of the Great Northern Lode. Other lodes were quickly found and taken up by the miners who shortly afterwards rushed the ground.

Prospectors' Gully falls W.N.W. into the Wild River. At the date of my visit the greater part of the bottom had been cleaned for about 1¼ mile up the gully, and the wash-dirt stacked ready for sluicing. Here and there lay groups of boulders of tin ore, gathered out of the washdirt—many of them nearly 100 lbs. in weight. These large boulders stopped about ¼ mile up the gully, below a reef of quartz showing tin ore in large lumps, which is seen on the right bank of the gully, striking S. 10 W. to N. 10 E. The wash-dirt in the gully above this lode is characterised by finer stream tin.

Shortly above the lode, the gully splits into three branches. Between the southmost and middle branches lumps of ore, from the size of marbles to the size of eggs, strew the surface in astonishing quantities. Without moving from the spot one might easily gather a stone weight of ore almost anywhere by reaching out his two hands. The whole of the "surface" here should pay well to wash. This surface ore leads up to the Great Northern Lode of the Prospectors. A shaft has been sunk on this to the depth of 6 to 10 feet. Twenty-six tons of ore, containing 60½ per cent. of tin, have been raised from this shaft and sold. Some of the ore was dressed up to 62 per cent., and a little up to 67 per cent. Four tons of this "first-class" ore from this shaft are lying down the creek; and about 20 tons of "second-class" ore, at present unsaleable, are lying at the mouth of the shaft.

The lode seen in the shaft appears to run N. 10 W. to S. 10 E. A quartz reef in nearly this line is traceable on the surface for about thirty yards to the south. The shaft proves nothing as to the thickness of the lode. A doubtful footwall is seen with six inches of ore lying on it. The apparent underlie (to the east) is steep, nearly vertical. Behind the wall is a thickness of at least two feet of "mullack." There are some signs of another lode coming in from the south, at least "blows" of quartz appear in that direction on the surface.

Nearly

Nearly in the line of the Great Western Lode, but divided from it by an east and west spur, Edward Coveney and party have commenced work on a lode running N. 10 W. to the boundary of the Great Northern License area. The lode is three or four feet wide, and has a good deal of ore in sight, mixed with quartz. There is a pretty distinct footwall.

Higher up the same ridge is the "Black King." The lode runs W. 10° S. to E. 10° N. A shaft has been sunk on it for about 15 feet. It shows about 3 feet of ore, mixed with quartz, and spotted with steatite. The southern wall (vertical) is distinct, with a clay face. The northern wall is not distinct, and the granite and stanniferous quartz take one another's places in a manner which it is not easy to account for.

The "St. Patrick" lode has the deepest sinking on the new field—about 30 feet. It runs W.S.W. to E.N.E., and is nearly vertical. In a short drive to the E.N.E. a face is seen 6 feet high, by 2 feet wide, of ore very little mixed with quartz. At the height of 6 feet from the floor of the drive the granite of the "country" crosses the face horizontally and cuts off the ore, from which it is separated by a thin seam of clay. The thin end of a wedge-shaped "horse" of granite comes in on the southern wall; while on the other side of the shaft a sharp "elbow" of granite intrudes into the lode. Fifteen tons of ore from this mine have been sold on the ground at the rate of £15 per ton.

North of the St. Patrick, and about the same level on the hillside, another lode is seen containing some good ore. Its direction is N. 20° W. to S. 20° E.

The "Wild Irishman" lode lies on the divide between the Wild River and Nigger Creek, on a slope which drains into a gully north of the Prospectors' Gully. Its course is S.W. and N.E. The N.W. wall only is distinct. The lode is about 4 feet wide and nearly vertical. Quartz and tin ore tend to arrange themselves in "floors," which dip to the N.W. side. Five tons of ore have been sold on the ground at £10 per ton. Six tons more are lying at grass.

On the next ridge to the north is the "No. 2 Wild Irishman," a mine which presents some peculiar features. The mine has not as yet been sufficiently opened up to make it plain which is the true line of the lode. I am inclined to think that the shaft is sunk at the intersection of two lodes. In one (N.W. and S.E.) a shoot of brown ferruginous tin ore, 2 to 3 feet wide, runs vertically for about 15 feet from the surface. At that depth the ore is to some extent replaced by "black slate"—*i.e*, black as gillaceous "gangue," with joints and faces coated with fibrous serpentine. A short drive has been made to the N.W. in the "black slate." Good ore has been struck under foot. A thick vein of quartz, with bunches of ore, crosses the shaft from S.W. to N.E. Fluor spar occurs in small crystals, both in the "black slate" and in the tin ore.

To the north-east of the last-named mine is the claim of Hugh and George Harrison—a large quartz blow, apparently running east and west, and with large bunches of tin ore. For the amount of work done a good deal of ore has been banked.

The "Poor Stroller" mine lies on the right wall of the Wild River Valley, opposite the township. A sinking of about 10 feet has not touched any wall; but judging from the lie of the ore the lode appears to run from W. 30° N. to E. 30° S. The "Poor Stroller" is a wide blow of quartz, with irregular masses of good ore.

About six miles west of the township, on the ridge dividing the Gulf (Walsh River) waters from those of the Pacific (Wild River) is the "Great Western" mine. On the hilltop, a hole is sunk on the outcrop of the lode, which runs S.W. and N.E., and dips to N.W. at 60°. It is apparently a dyke of granite impregnated with tin and iron ore. There is red granite on the hanging-wall, and a quartz vein, mixed with tin, on the footwall. In this hole the dyke is seen tapering to a point at the north-east end from 2 feet wide at the S.W. end. A few feet to the S.W. of the hole referred to a shaft is sunk on the reef about 20 feet deep. The reef widens greatly at the bottom of the shaft. The hanging-wall (underlie 60°) is of fine-grained red granite. Beneath this is a 3 feet dyke of coarse-grained granite or elvan, impregnated to the extent of about one-half with tin ore. Next in order comes about 4 feet of profusely-jointed granite, with but little tin; but at the height of about 5 feet from the bottom a floor of tin ore crosses the granite nearly at right angles to the plane of the hanging-wall. Above this comes a layer of quartz mixed with tin ore, succeeded by a second floor of ore. Above this floor is quartz, with a leader of tin ore passing vertically up to the surface. Below the 4 feet of granite and quartz last described comes more quartz, with some tin, but no clear foot-wall has yet been exposed. The lode thus bulges immensely just below the place where it pinches off at the surface.

Numerous other small openings have been made on the same hilltop on outcrops of quartz showing outcrops of tin ore.

The "country" in which the tin lodes occur is a sort of nondescript rock—a granite or porphyry, in which granular quartz largely predominates. There is little felspar, and very little mica.

With the exception of fluor spar and wolfram (which is more common), few minerals other than tin ore have yet been met with in the mines. The ore in the lodes is cassiterrite, or binoxide of tin, in amorphous masses. When pure this ore contains 78·38 per cent. of tin. Worn crystals are occasionally met with in the stream-tin. The ruby, amber, and wood varieties are not unknown. Gems are rare.

I am indebted to Mr. Denny, assayer, Herberton, for the following list of current prices of ore on the field:—

Stream Tin	per ton,	£33
Lode Tin, 70 per cent.	"	30
" 67 "	"	27
" 65 "	"	20
" 60 "	"	15
" 55 "	"	10
" 50 "	"	4

Carriage to Port Douglas costs £8 to £10. Total expenses to Sydney, £13 to £17.

Setting the above prices against the cost of production, it is evident that low-class ores are not workable at a profit, unless they are very easily obtained. On the other hand, there is nothing but the mechanical adhesion of quartz, and in some cases granite, to be overcome to bring the ore up to a high percentage. It cannot be long before all the accessible unmixed ore is worked out, and in that case the extinction of a promising new industry cannot be far distant; but with the erection of stamping and dressing machinery, the enormous quantities of ore which undoubtedly exist on the field will, when freed of

of their mechanical impurities, command a ready sale. It is satisfactory to learn that Mr. Moffatt, of Tent Hill, N.S.W., proposes at once to erect machinery—the one thing wanting, in my opinion, to secure the permanency of the field.

The various lodes have hardly as yet been opened up, and as a general thing one wall at most is all that the miner has to guide him in following the lode. Much is heard, on the field, of the lodes being "mere surface blows"—a false alarm, I am certain, in many cases. It is a very common experience to find that lodes or reefs do not "form properly" till they have been followed—often in doubt and perplexity—for some depth: in other words, the true character and relations of the undisturbed lode or reef cannot always be seen till the work has been carried beyond the direct influence of the superficial agents of waste. Considering how, in the neighbourhood of Herberton, the ore is seen at the surface over such a large area, and at such various levels, I find it incredible that denudation should in every case have reached, and stopped at, the bottom level of the metallic deposit. I have no doubt whatever that many of the lodes "go down" as far as their owners could possibly desire.

About eighty men are employed on the field at present in lode-working or streaming. The stream workings have hardly had a fair trial, as they have not yet seen a wet season, but are believed not to have more than averaged wages. The principal seats of this industry are the Prospectors' Gully, the Wild River near Herberton, and the Dry River about ten miles down. It is expected that the alluvial deposits near Mr. Garbett's station, down the Herbert, will employ a number of men after the ensuing wet season.

I returned to Thornborough by the Cardwell road, which crosses the Walsh five times. The granite country extends down to the last crossing, after which the sandstones and slates continue to Thornborough.

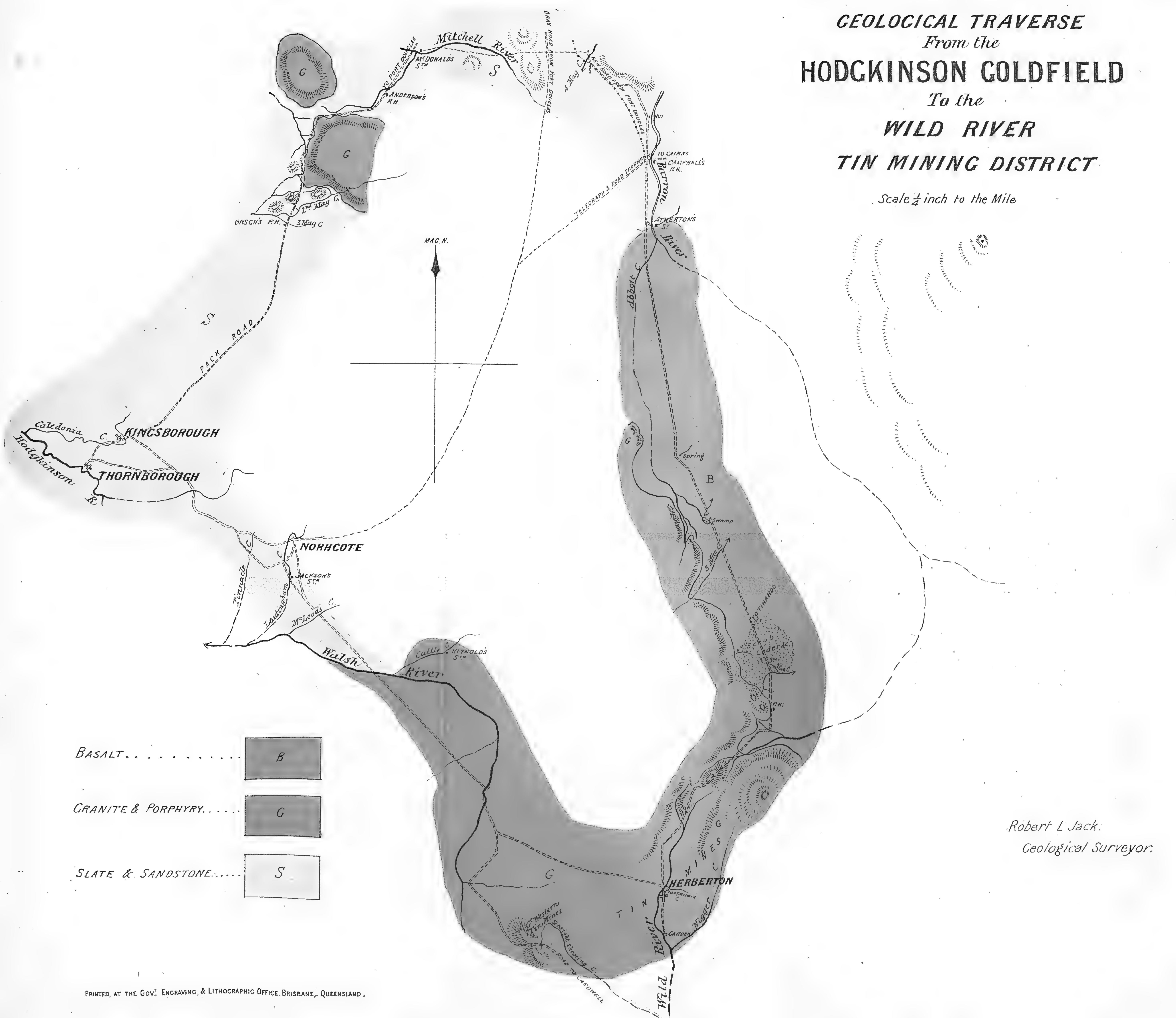
ROBERT L. JACK.

Thornborough, 27th October, 1880.

The Hon. the Minister for Mines, Brisbane.

Price, 6d.]

By Authority: James C. Beal, Government Printer, William street, Brisbane.



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1885.

QUEENSLAND.

REPORTS ON THE GEOLOGICAL FEATURES OF PART OF THE DISTRICT TO BE TRAVERSED BY THE PROPOSED TRANS-CONTINENTAL RAILWAY, BY ROBERT L. JACK, GOVERNMENT GEOLOGIST.

Presented to both Houses of Parliament by Command.

FIRST REPORT.

Cloncurry, 12th October, 1881.

To Major-General The Hon. W. Feilding.

Sir,

Having received instructions from the Hon. the Colonial Treasurer to join the Transcontinental Railway Survey Party at Cloncurry township, on 10th September, and there to place myself under your direction, I left Townsville on the 26th of August, and reached Cloncurry, a distance of 558 miles, on the 20th September. My start was delayed for ten days by an accident which I sustained while riding out to purchase horses for the journey, but I was still in time to join you, as you only arrived on 7th instant.

The following notes embody my observations—(1) on the journey, (2) on excursions made from Cloncurry as a centre while waiting for you, and (3) on excursions made in your company.

The district to be described is included in sheets 2 and 4 of the new map of Queensland, on the scale of 16 miles to the inch.

It will be readily understood that my opinions on points of geological theory may be modified by further evidence in the course of the investigation which is still going on.

In view of a possible junction of the Transcontinental Railway with the line which is now nearly completed to the Charters Towers Goldfield, and the further extension of which to Hughenden has recently (as I learn) been authorised by Parliament, my notes on the journey from Hughenden down the valley of the Flinders to the Cloncurry may possess some interest for the Syndicate. Moreover, it is quite possible that the evidence bearing on geological questions of commercial importance, relating to the district to be traversed by the proposed railway may be looked for and found in distant parts of the colony.

The granite range, dividing the Burdekin from the Flinders, is crossed by the Hughenden road, at an elevation of 3,010 feet above the sea level. It is flanked by a deposit of basaltic lava, in nearly horizontal beds, which extend to Dalrymple on the east, and to Tatoo Camp, seven miles above Wongalee Station (1,840 feet), on the west. Here a gully cuts through the lowest bed of basalt, and exposes about 50 feet of the underlying "desert sandstone." The sandstone is of the usual type, white or yellowish, with a false-bedding, and with soft ferruginous portions, apt to weather into caverns. The only fossils observed were some twig-impressions. Spinifex grass at once takes possession of the soil where the desert sandstone comes to the surface. It, however, covers on the Hughenden road only a narrow belt of country.

The basalt occurs in outlying table-mountains between Porcupine Creek and the Flinders, as far as Mount Beckford, and in all probability once covered a great part of the downs.

Twelve miles from Hughenden, a gully, rising in Mount Beckford and falling into Porcupine Creek, exposes a section of about 12 feet of horizontally bedded grey clay shales (or "blaes," in the language of the coal miner), with thin bands of grey flass and "damper"-shaped nodules of magnesian limestone, each enclosed in an envelope of glittering carbonate of lime. This is the first section of the strata which underlie the desert sandstone, and which have been determined, from the fossils collected by Daintree, to be of cretaceous age.

Similar strata are exposed at Hughenden, in the Chinaman's Gully, and at the washpool from which Daintree obtained some of his fossils. I could see, however, only a few belemnites and some shells, all in bad preservation.

Hughenden, 1,600 feet above the sea level, situated on the left bank of the Flinders, is a thriving little township which has sprung into new life within the last three years, chiefly owing to the stocking with sheep of the stations on the Flinders and Diamentina. It possesses a court-house, post-office, forge, three hotels, a bakery, three general stores, two saddleries, a bank, and a number of private residences. Since the date of my visit, Hughenden has been connected by telegraph with Charters Towers and the Cape Diggings. When the township becomes the terminus of the Townsville Railway, it will supply the

Sheep

sheep stations of the west, and enable them to send their wool to the coast without crossing the stony basalt country and the formidable coast range. I could form some idea of the extent of this traffic, which is yet in its infancy, from the number of waggons met with between Townsville and Hughenden, each groaning under its load (3 or 4 tons) of wool bales. Carriage by dray, for 500 or 600 miles, it is needless to say, is very expensive. The loads are on the road for months, and each dray involves the employment of a score of bullocks, or an equivlalent number of horses.

The Flinders, at Hughenden, has a sandy bed, 200 yards wide. Eighty miles down the river, at Richmond Downs, it is only 30 yards in width.

The Cloncurry road hugs the left bank of the Flinders, as far as it is possible, viz., to near the mouth of Neelia Creek, going considerably more to the north than is necessary. The object of this deviation is to get water for camping purposes; and water can be found at all seasons—either in holes in the river bed or in ana-branches.

The road passes Telemon and Marathon Stations; and at Richmond Downs, 83 miles from Hughenden, may be seen the rudiments of a township. Besides Messrs. Bundock and Hays' head station, there are a Chinaman's garden, store, public-house, and post-office. Here the road branches off to Cambridge Downs sheep station, the Upper Saxby, and the Woolgar Goldfield. The latter, which was only discovered in 1879, is already rising into importance as a reefing district. Thirty-nine miles below Richmond Downs is Low's public-house and store. From Low's to the crossing of Neelia Creek is a distance of 40 miles; thence to Julia Creek, an affluent of the Cloncurry River, is 25 miles—without water in the dry season. (Julia Creek is incorrectly located on the map.) The creek has a fine waterhole at the crossing of the road. Eddington Station is 12 miles further, on Eastern Creek, which has also large permanent waterholes.

Eight miles SW. of Eddington Station the Gilliat River is crossed. Water is to be found in each of its tributaries, viz., Gidya Creek (4 miles); Holy Joe's Creek (6 miles); and Box Creek (4 miles). These creeks are not shewn in the map. Ten miles from the creek last named is the Fullarton River, on which Messrs. Nesbit and McEachern are forming a new station named Strathfield; thence to the Williams River is a distance of 16 miles. (Water.) Fourteen miles from the Williams, at the first crossing of Fisher's Creek, a tributary of the Williams, the "rolling downs" come to an end, and auriferous and cupriferous country begins. In 10 miles more, Fisher's Creek is again crossed near its head. Here there are two wells, and the "Queensland" quartz crushing machine. The township of Cloncurry is about 12 miles distant from the wells.

The "rolling downs" extend from Wongalee to Fisher's Creek. They are well grassed, mainly with the nutritious Mitchell grass, but singularly bare of timber. When a line of trees is seen in the distance, it may safely be presumed to mark a watercourse or chain of lagoons—more likely to be dry than not. The soil is excellent, being derived (except in alluvial bottoms) from the waste of shales, sandstones, and limestones, with a happy mixture of the debris of the denuded basaltic table-land. It is capable of being turned to good account for agricultural purposes, if water can be made available. At present its pastures support sheep and cattle in numbers which, though immense, still come far short of their capacity.

Without entering fully into the question of the geological age of the downs, I may mention that I believe the strata to form one continuous series representing part of the cretaceous and oolitic formations. Apparently they form from east to west a large synclinal trough, with an axis crossing the Flinders in the neighbourhood of Marathon. At the heads of the Flinders the lowest beds do not crop out, as they overlap the palæozoic and metamorphic rocks of the dividing range, and are covered by the basalt of the table-land. To the west of Richmond Downs, however, a gentle dip to the east brings up to the surface a series of strata which apparently occupy a lower horizon than those in the centre of the trough. From Hughenden to Marathon the strata consists for the greater part of grey shales, with nodules of magnesian limestone, and grey and brown sandstones, which are occasionally calcareous and nodular. Near Richmond Downs, where an easterly dip is for the first time distinctly observable, the limestones take a different character, and are distinguished by a prevalent cone-in-cone structure. Further west there are fewer shale beds, and thicker and browner sandstones. The latter are extensively veined with gypsum; and I have been informed by squatters and others, that *beds* of gypsum are frequently met with in sinking wells. The whole series is fossiliferous. I should not be surprised if the strata west of Richmond Downs should be pronounced on palæontological evidence to be of older date than those to the east, although some of the fossils are common to the whole series. It is, however, premature to speculate on the question till the fossils which I have collected shall have been worked over by a palæontologist. My friend and late colleague, Mr. Robert Etheridge, junior, of the British Museum, will probably undertake this task, for which his previous labours in Australian palæontology peculiarly qualify him.

Near Fisher's Creek, where the "downs" beds abut on the metamorphic rocks of the Cloncurry district, the strata are upturned and altered, the limestones becoming crystalline and the sandstones assuming the character of hard quartzites. Even in the crystalline limestones, however, some fossils were obtained in a state of exquisite preservation.

At intervals to the west of Hughenden, the desert sandstone occurs in isolated table-mountains capping the strata of the downs. Notable among these are Mount Walker, between the Flinders and Walker's Creek, a table-land between Porcupine and Betts' Gorge Creek, and two table-mountains between the Flinders and the Dutton. Another outlier of the same sandstone rests on gneiss between Mount Leviathan and Chinaman's Creek, on the left bank of the Cloncurry. Others occur, I believe, resting on metamorphic rocks, in the neighbourhood of the Soldier's Cap, although I have as yet only seen that locality from a distance. There can be little doubt that the desert sandstone formerly extended over the length and breadth of the downs.

Two questions of the utmost importance arise with reference to the "downs" strata, viz.: the supply of water and coal.

To convert the pastoral downs into rich agricultural country (for which the soil is admirably suited) would enhance the market value of the land to an extent which I hesitate to express in figures. This conversion, however, is only possible through a comprehensive system of water-raising and distribution, which

which would permit of systematic irrigation. Wells would have to be sunk under the direction of a competent hydraulic engineer; the land to be disposed of would have to be portioned out in suitable water districts; and the agricultural settlers would have to purchase or rent their water privileges. If my theory, that the downs strata form a great synclinal trough, be correct, we may expect to find the greater part of the drainage of the dividing range between the Flinders and the Burdekin, and of the McKinlay ranges, lodged in the more pervious beds of the series, under conditions favourable for artesian wells. It will be necessary, however, to investigate the geological structure of the downs much more minutely than I have been able to do, before a reliable opinion can be arrived at on this point.

The other question—that of the existence of coal under the downs, is of no less importance.

Coal seams have been discovered in wells at Tambo, Aramac, Vindex, and Winton, at no great depth below the superficial "cretaceous strata" of the downs. I observe with pleasure that the terms of your instructions will give me an opportunity of visiting some of these localities, when I hope to find out something definite regarding the age of the coal. If, on the one hand, the coal seams are truly interstratified with the "cretaceous" rocks, there will be every reason to believe that they extend over an immense area beneath the downs. On the other hand, if, at the localities referred to, the "cretaceous" strata overlie uncomformably the palæozoic coal measures of Newcastle and the Bowen River, we can rest assured of the existence, under the proposed line of railway, of immense stores of coal, regarding which we already know something definite, and which are of proved value.

It now only remains for me to add a few notes on the metalliferous district in the centre of which you are now camped. The details must be reserved till my survey has been completed, as I expect to spend some little time here on my return from the North.

From Cloncurry as a centre, my travels have extended (while waiting for your arrival) north-westward to the Dugald River (45 miles), southward up the Cloncurry Valley for 30 miles, to the "Top Camp" Gold Diggings, and eastward to the copper and gold mines near Mount Douglas. I may mention here that I am under deep obligations for guidance and assistance to Mr. Reginald Uhr, Police Magistrate at Hughenden; Mr. Ernest Henry, the discoverer and part owner of most of the copper mines in the district; and lastly, to Mr. A. Macphail, whose experience, as prospector and miner, is extensive and practical.

In latitude 20 degrees 10 minutes south, a porphyry range divides the Dugald from the Leichhardt waters. Some copper lodes occur, I am informed, in the porphyry. Between the range and the Dugald is a belt of nearly vertical black slate and quartzose greywackes, with a bed of limestone. In this belt are some copper and lead lodes, which I visited in company with Mr. Uhr. The lead selections lie nearest the range, and occur in a wide lode which can be followed on the surface for nearly a mile, from north 20 degrees west, to south 20 degrees east; not only by the continuous outcrop of gossan, but also by the absence of vegetation. At the north end is a mass of gossan, stained with carbonate of copper, and mixed with plumbago. From this point for three-quarters of a mile to the south, a wide belt of lead gossan is seen, containing red oxide of iron and yellow lead ochre, along with decomposed plumbago shale. Two shafts have been sunk, one of them to a depth of 20 feet, with a trench at the surface, 17 feet long and 8 feet deep; trench and shaft alike exhibit a gangue of what may be described as graphitic shale foliated and contorted, and all more or less impregnated with yellow lead ochre and peroxide of iron; some red oxide of lead also occurs in places. One tongue of lead ochre extends from the top to the bottom of the shaft with a slight underlie to the east. At a depth, the usual change from lead oxides to carbonates, and finally to galena, may be confidently expected to take place. Assays of the ore by Mr. Karl Staiger showed antimony, and traces of silver as well as lead.

Lead lodes of such an extent are very rare, and as most Australian lead ores contain a payable proportion of silver, I consider that the prospects of the Dugald mine are very good.

At the south end of the lode its character alters. It shows there a red gossan, with stains of carbonate of copper.

A mile to the south-east of the lead lode is the No. 1 copper selection. It lies among upturned and altered stratified rocks. Near the river is a white crystalline limestone 50 or 60 feet thick, with siliceous granules, and specks of black mica, dipping at 75 degrees to east 10 degrees south. Below the limestone is a series of grey siliceous and talcose slates or shales, impregnated and coated with green carbonate of copper. This series is of varying thickness—at least 100 feet—and is accompanied by a weathered granular siliceous and hornblendic rock, impregnated with carbonate of copper ("green gossan"), especially in the form of amygdaloidal kernels. These masses evidently are not part of the stratified series, but vein deposits or gangue, as they intersect the bedding in places, although their general tendency is to follow it. Two trenches have been cut across the outcrop of the cupriferous zone or lode (which runs north 10 degrees east); one trench is 22 yards long. It discloses a considerable quantity of the "green gossan," which cuts in and out of the bedding of the stratified rocks. The second trench is 20 feet long and 8 feet deep. It shows towards the bottom large blocks of ruby oxide coated with green carbonate, and frequently containing veins of native copper. The oxide is remarkably pure. Besides the "green gossan" large masses of ferruginous gossan occur on the cap of the lode. Large lumps of carbonate and oxide of copper can be picked up loose in the gullies near the lode.

Williams' Creek rises in granite country, which should be prospected for tin ore.

Mount Leviathan, on the left bank of the Cloncurry River opposite the township, is a mass, say 200 feet high and a quarter of a mile in diameter at its base, of the purest possible iron ore. The greater part of it is massive or granular specular iron ore, with only a few grains of siliceous sand. Specimens of foliated specular iron may be picked up, and parts of the mountain are of magnetite. The specular iron is frequently magnetic. From the summit a number of quartz reefs and ironstone lodes may be seen radiating from the mountain. Such an inexhaustible mass of ironstone would be very valuable if the carriage to the manufacturing districts were not excessive. Two hundred and ten miles of railway would connect this ironstone with the Winton coal, when the rest of the railway might be constructed with locally manufactured steel. It is not impossible that, with a short line connecting the Cloncurry with Point Parker, manufactured iron might even be exported at remunerative rates.

Half-a-mile south of the township, is a smaller hill of specular ironstone, equally pure.

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The "Great Australian" Copper Mine lies between the last-mentioned ironstone hill and the township. It may almost be described as a mountain of copper. It occurs as a ridge about 30 feet in height and over 100 yards in length, with a general trend from north to south. It is intersected by two cross lodes, and has several branches. A detailed description is in preparation. At present I can merely say that numerous trenches and shafts only lead to the conclusion that "there is no end to it." The most valuable ore is the red oxide, which is obtained in great purity, and often contains large masses of native copper. The cap of the lode is composed of a siliceous matrix with green carbonate.

About a quarter of a mile to the south-west is another large deposit of copper known as the "Contra Lode." It occurs in diorite country. Its trend varies from west 15 degrees north to west, and the lode is traceable for about 400 yards. It is at least ten feet wide, and has a large ironstone cap with much green, and some blue, carbonate. Not much has been done beyond some stone breaking on the surface, a little trenching, and the sinking of a shaft about 20 feet deep. The latter shows a thickness of about two feet of pale red oxide of copper, locally but incorrectly known as "grey ore," with some copper pyrites and much green carbonate. Its eastern end is crossed by a gully whose alluvium obscures the outcrop. When it is next seen it has become almost entirely an ironstone lode, and a little further it changes to a vein of white calc-spar impregnated with carbonate of copper.

The "country" in the immediate neighbourhood of the Cloncurry copper lodes and township is composed of vertical slates and sandstones, with some crystalline limestones, the whole intersected by intensive masses of diorite.

Eastward towards the Mount Douglas mines (which I visited before your arrival, and afterwards in company with you), similar country prevails, with the addition of peculiar rugged knobs of granular quartzite. Unless these latter be the discharge-pipes of "geysers" which poured out hot water containing silica in solution, I am at a loss to account for them.

On the north bank of Pumpkin Gully, a copper lode (nearly vertical) runs from south-west to north-east. It has a large cap of red ironstone, and green fibrous carbonate of copper, with some very blue azurite. Part of the gangue (which is siliceous) is mixed with red oxide of copper and "grey ore" (sulphide of copper and antimony). The lode is traceable for a quarter of a mile across Pumpkin Gully; only one hole has been sunk, about four feet deep.

Half a mile to SSE. is the "Flying Dutchman." It runs east and west and underlies to the north. The country is sandstone, with fine grains of mica. The matrix of the lode or reef is sandy (siliceous). The mine was originally taken up as a gold reef, and Mr. Macphail informed me that the stone, when crushed at the Queensland Machine, averaged 1 ounce 3 dwts. of gold to the ton. All that remains to be seen at the shaft is a quantity of glassy quartz, with green fibrous (radiated) carbonate of copper, and some grey copper ore.

Three hundred yards east of the "Flying Dutchman" is the Homeward Bound Copper Lode. It runs north and south. The shafts have become unsafe, but a little of the ore is lying about—green and blue carbonates, and some red oxide and native copper The copper ore is said to have contained gold. A good deal of ore from this mine is stacked at the Queensland Machine.

North-west of the "Homeward Bound" is the "Uncle Tom" Gold Reef. Guided by Mr. Macphail, I explored, in your company, the galleries of the mine, and visited the bottom of the shaft (80 feet deep). The reef runs north 10 degrees west, and has an underlie at about 70 degrees to the west. North of the shaft the country is gritty hard sandstone or greywacke, and south of the shaft, slate crosses the reef, with an east and west strike. The reef averages two feet six inches in width, but the stone frequently penetrates the foot-wall. The stone is a white glassy quartz with pockets of hæmatite iron ore, and numerous veins of calc-spar, and some chalybite (carbonate of iron). About 800 tons of stone have been taken from the reef, which averaged 16 dwts. of gold to the ton. I have in my possession at Townsville some specimens of free gold in calc-spar from the mine. A peculiarity of the reef is that the stone is apt to run off in floors or shelves, which dip to the north where the reef traverses sandstone country, and to the south in the slate country.

At the bottom level there was no sign of water but "mundic" (meaning in this case copper pyrites) had begun to make its appearance, an indication that the water level was near. The reef was abandoned in 1877, when rations and everything else were at famine prices. As examples, Mr. Macphail informed me that flour was £7 10s. per 200 lb. bag; sugar, 1s. per lb.; candles, 2s. 6d; powder, 2s.; fuse, 3s.; and steel, 3s.

The "Uncle Tom" Reef is on the divide between Pumpkin Gully and Fisher's Creek. All the gullies draining into Pumpkin Gully have a shallow wash, containing gold throughout, at the rate of $2\frac{1}{2}$ dwts. to the load. The whole of the gravelly surface is auriferous in about the same degree. The great difficulty is water, which is obtainable for only a month or two in the year. With water, the whole hill would pay for sluicing. Mr. Macphail dug out four bags of dirt, which we packed (say 280 lbs.), to the well at Fisher's Creek, where he washed them in your presence and in mine. The result was above 7 grains of gold, and a few specks of metallic bismuth. The gold was scarcely at all rolled, and was evidently not far from its source.

It is obvious that the whole of the gold which is so evenly distributed over the drainage area of Pumpkin Gully cannot have come from the few reefs which are now visible. Its chief source is perhaps to be found in reefs whose outcrops have been completely denuded and covered with surface wash.

Mr. Macphail also washed "colours" of gold from Fisher's Creek, below the well, in our presence.

As you have arranged to visit the Duck Creek Copper Mines, and to return to Cloncurry *via* the Top Camp Gold Mines, and this will afford me another opportunity of seeing them, I shall defer reporting on them till after our return.

I have, &c.,

ROBERT L. JACK.

SECOND

SECOND REPORT.

On the 15th and 17th October, General Feilding, Mr. Robinson, and I, visited the copper mines of Duck Creek. and the the gold diggings of the "Top Camp" at the Cloncurry, under the guidance of Mr. Ernest Henry.

After crossing to the left bank of the Cloncurry, opposite Mount Leviathan, the road to the township of Boulia (on the Bourke River) keeps a general SSW. course, crossing Chinaman's Creek (three times), Slaty Creek, Duck Creek, and the Malbon River.

Copper lodes occur on the western side of the road in a belt of country extending from Slaty Creek (near Mount Sheaffe), southward to the Malbon—a distance of about 13 miles. This country is for the most part slaty, but is bounded on the east by quartzite ranges which run north and south. The quartzites are probably beds of altered and upturned sandstone. They still bear traces of vertical stratification.

On the roadside, two miles south of Mount Leviathan, thick beds of limestone were observed. They were vertical, and had a NE. and SW. strike. The limestone was of a magnesian variety, with a slight mechanical admixture of siliceous granules. This lime ought to form a good hydraulic cement.

About three miles further, we saw, in slate country, on the road side, a number of quartz reefs and hæmatite lodes, striking to the NE.

In a gully between the last crossing of Chinaman's Creek and Duck Creek waters (say 13 miles from Cloncurry township), I picked up large blocks of psilomelane (hydrous peroxide manganese).

The road crosses the watershed between Chinaman's Creek and Duck Creek by an easy gap, in slate country, between two ranges of quartzites, which run, roughly speaking, parallel to the road. Supposing the railway to cross the Cloncurry River near the township, the ore from the copper mines about to be described would naturally (and I believe easily) be brought down to the railway by road, tramway, or branch railroad.

The northmost of the copper lodes (Selection No. IX)* is situated on the west side of the road, about 20 miles from the township, and within the drainage area of Slaty Creek, a large tributary of the Cloncurry. It is about one mile to the north of Mount Sheaffe, whose position is given on the map.

The state of the country in which the lode occurs, strikes WSW. to ENE. Near the lode is a mass of diorite. Its relation to the slate is not very clear, but it is, in all probability, intrusive, and may be suspected to have influenced the production of the copper ore. The principal lode strikes WNW. to ESE. For about twenty yards it stands seven or eight feet above the ground. It has a quartz matrix, with great pockets of green carbonate of copper, red oxide, and "file ore." A branch lode strikes off it to the south-east. It contains some green carbonate, which I should estimate to contain 40 per cent. of metallic copper, and some red oxide mixed with silica, which I should reckon 30 per cent. ore. From what can be seen at the surface, I should say this mine is capable of turning out a large quantity of payable ore.

The Rainbow Lode (marked "2454" on the map) lies about three and a-half miles to the south of selection No. IX., on the fall of Cone Creek, a tributary of Duck Creek. It occurs in flat country, and shows a "blow" (striking WSW. and underlying to SSE.) of green carbonate of copper and gossan. A shaft has been sunk to the depth of 25 feet. The ore now lying at grass came from the bottom of the shaft, and is of very good quality—red oxide and green carbonate of copper (the latter enclosing quartz crystals), and silver-grey copper ore (sulphide of copper and antimony).

The lode is traced for over 100 yards. At its west end it is crossed by a quartz reef running NW. and SE., and showing some red oxide of copper and some grey sulphide of copper and antimony. I consider the Rainbow quite a payable mine.

A section (No. 2452) adjoins the Rainbow to the NE., and is understood to be on a continuation of the latter; but we had no time to visit it.

Two miles to the SW., on the eastern or left bank of Cone Creek, we saw a large reef of quartz, with pockets filled or cavities coated with green carbonate of copper. The reef runs east and west through slate, which has the same strike. It is more than likely that payable deposits of copper ore exist below the surface in this reef.

A selection has been taken up on the right bank of Cone Creek, on what is supposed to be the prolongation of the reef or lode last referred to.

A quarter of a-mile further down the creek (left bank) is a similar reef, striking east and west in a country of chloritic slate, having the same strike. The reef is at least 25 feet wide. It shows green carbonate and red oxide of copper of good quality, and I have no doubt will prove a valuable property, the large cavities lined with green carbonate in all probability representing "bunches" of ore. The ore, as well as the slate, is chloritic.

The selection No. 2459 is taken up on a little outcrop of green carbonate of copper in a quartz reef running east and west, apparently of not much account. It lies on the right bank of Cone Creek, near its junction with Duck Creek, and about a mile SSW. of the reef last described.

The Chinaman's Lode occurs on the left bank of Duck Creek, about a mile and a-half SE. of No. 2459. It runs from west 30 degrees south to east 30 degrees north. It is a quartz reef, standing from 3 feet to 15 feet above the general level, and measuring 17 feet across. It runs for nearly a quarter of a-mile through slate, whose strike is parallel to the lode. The quartz has its cavities coated with green carbonate of copper, and very often the quartz when broken up is found to be intimately mixed with carbonate of copper. Both slate and ore are highly chloritic.

In the selection numbered 2458 (2 miles WNW. of the Chinaman's) I saw two lodes. The first runs west 10 degrees south, is well defined, and about three feet wide, with a dip to south 10 degrees east at 75 degrees. Besides green carbonate of copper and some hœmatite iron ore, a good deal of very fair grey ore is visible. This is a sound payable lode.

A second lode parallel to that last described is said to occur in the same selection, but we were too pressed for time to visit it.

A hundred

* For details, see Map, on the scale of half an inch to the mile.

A hundred yards to the south, still in the same selection, is a third lode with two quartz reefs running to the SW. A considerable quantity of green carbonate of copper is visible on the surface of the lode. The country is chlorite, slate, and greywacke turned up on end, and having a strike to WSW

Selections Nos. 2457 and 2456, are taken up on continuations of the lodes in selection No. 2458, and carry their outcrops on to the ENE. for about half-a-mile. We had not time enough to inspect these properties.

Nine miles SSW. of the group of lodes last described, two copper selections (Nos. III. and V.) have been taken up on the south or right bank of the Malbon. As the time at our disposal, however, was very limited, we did not inspect them. They lie about 33 miles from the Cloncurry township, by the Boulia track, which is a good practicable road. Probably, however, if the railway should touch at the Cloncurry township, a tramway or branch railway would supersede the road, and it might keep a pretty straight course, and yet need never be much more than a mile from any one of the whole chain of mines extending from Slaty Creek to the Malbon River.

From the copper selection No. 2458, we ran down the right bank of Duck Creek for nine miles in a general south-easterly direction to the point where the Malbon River comes in from the west, and the Cloncurry River from the SW. Then keeping down the valley of the Cloncurry, for eleven miles further to the NE., we reached the "Top Camp," which is about 30 miles up the river (south) from the township.

At the Top Camp the country is of slate and greywacke, both chloritic, in nearly vertical beds, which strike SE. and NW. The slate makes very bold and striking features on the tops of the hills, often standing up in fantastic knobs. The slate and other stratified rocks are often pierced by enormous dykes or reefs of quartzite, which stand up in lofty walls on the crests of the mountains.

At the head of Armstrong's Gully, in slate country, is a hill named the "Mary Douglas," in which a quartz reef was taken up, and worked for some time (up to 1878). A good deal of gold was obtained in association with native bismuth. Owing to the tumbled-in state of the workings I could see little of them, but I was satisfied that the reef or leader which was worked did not extend far horizontally. Whether it did so vertically, I had no means of judging. Numerous small quartz veins were seen in the hill, but none of any extent. The crown of the hill is so bare that no large quartz reef could escape observation.

The quartz of the reef which was worked is very peculiar, being coated with botryoidal and stalagmitic masses of glossy-black limonite. Sometimes the quartz is marked with impressions of large cubical crystals (probably of pyrites) which have weathered out.

The surface wash on the slopes and base of the Mary Douglas Hill yield colors of gold,—and from the hill there radiate in every direction gullies and alluvial flats which have yielded gold extensively, at one time employing 400 men. Prominent among these are the Chinaman's Flat (in which a 28 lb. nugget of gold was found), Red Jack Flat, and Sharkey's Flat. Chinaman's Flat runs to SSW., and has been worked out nearly for half-a-mile. It takes its rise in some gullies known as the Jeweller's Shop, Dycot's Gully, Ironstone Gully, and the Secret Lead. Sharkey's and Red Jack Flats run ENE., and have been worked out for about half-a-mile each. Linger and Die Gully runs to the west of and parallel with Chinaman's Flat, and has been worked for a quarter of a mile. The workings generally have bottomed on the slate rock at depths varying from 20 to 40 feet. I have been informed that all the gold obtained from the alluvial diggings at the Top Camp was heavy and nuggetty. It must have been derived from the denudation of a number of quartz veins in or about the Mary Douglas Hill.

That such an extent of alluvial country should have been profitably worked under the present conditions—not a drop of water being visible in the flats for more than half the year—is very surprising If water were brought from the upper reaches of the Cloncurry, the whole of the flats might be washed down in a face by hydraulic power.

On my previous visit to the Top Camp I returned through the mountains on the right bank of the river, and saw much similar country, with alluvial flats apparently promising equally well, but this ground is still untouched by the miner, and I could not prospect it for want of water—and time.

From 21st to 30th October inclusive, General Feilding and I were out to the west of the Cloncurry valley, inspecting another metalliferous region, under Mr. Henry's guidance. Mr. Henry was so unfortunate as to break a rib and have both his eyes almost closed up by swelling blight during this excursion; but although suffering great pain, that indefatigable explorer insisted on carrying out his whole programme.

Camping in the afternoon of the second day on the Dugald River, we visited the "Number 1" copper mine and the lead mine described in my previous report. On the third day we continued our journey up the left bank of the Dugald in a general SSW. direction.

Three miles from the camp we passed a large "blow" of quartz running north and south, with a ferruginous gossan on its east side, containing a few specks of lead ochre. This reef is probably the continuation of the lead lode.

A quarter of a mile to the SE. we saw another good copper lode (iron-cap and green carbonate). It ran east and west, with an offshoot running to the S.E.

About five miles further (to the south), we passed a singularly barren piece of bare rocky country. Fine-grained greywacke beds, about six feet in average thickness, stood on end. The beds had a north and south strike and a marked east and west cleavage. The greywacke varied in composition and color, being sometimes blue and calcareous, and sometimes nearly black and full of iron pyrites.

From our camp near No. 1 copper mine our general course up the Dugald was SSW. for the first 30 miles, when the valley narrowed to a ravine, which we ascended for three miles to WNW. Up the river the slates and greywackes gradually became more altered, sometimes to mica schists and gneiss, but they always have a recognisable N. to NW. strike. Huge quartzite dykes or reefs cross the valley. Where one of these crossed the river near Mount Eurio we found a waterhole and camped. There was no water in the river between this and where we last camped, 33 miles down.

Accompanied

Accompanied by Mr. Henry, I ascended Mount Eurie and some higher eminences in the neighbourhood. Here Mr. Henry broke his rib by falling on a pointed stone. Mount Eurie is capped by a thick vertical bed of limestone, a good deal altered, but full of a fossil like *Lithostrotion*. The limestone is accompanied by slates with a north and south strike.

I obtained from Mount Eurie an extensive view to the south over a tumbled wilderness of slaty mountains, intersected by great dykes of quartzite and reefs of white quartz. The features of the country strongly remind me of the Hodgkinson Goldfield. Very few, I think, even among northern miners, have any idea of the extent of this tract of possibly auriferous country.

In a valley to the west of Mount Eurie, Mr. Henry and I found some fine almandine garnets, Labrador felspar of the beautiful irridescent variety used in jewellery, some micaceous iron ore, and some lumps of rotten ironstone with slight copper stains, such as generally yields gold in the Cloncurry district.

In 12 miles to the SW. we reached and camped on a waterhole in Argylla Creek, a tributary of the Leichhardt. Our camp was shared by a small party of aboriginals, of the circumcised tribe of Calcadoons. They treated us with civility after their fashion, and stole nothing. Mr. Henry's dray, which had been left near the place for two months, was found to be untouched.

From the Mount Eurie to the Argylla camp the country was somewhat broken and ridgy. The rocks were slates and greywackes (striking north and south), sometimes chloritic and sometimes siliceous, occasionally altered to schists and gneisses, and traversed by huge "blows" of quartzite and smaller reefs of quartz, often iron-stained and cavernous—rather likely country for gold, I thought. Three miles from the Mount Eurie camp, we passed a little rock-bound waterhole near the head of the Dugald, and shortly afterwards crossed some ridges to the Leichhardt waters, passing on the way two or three smaller outcrops of copper ore.

Near the head of Argylla Creek is the Argylla Copper Mine.

The Argylla Mine is a wide belt of copper-bearing country running NNW. to SSE. The dominant feature of the belt is a wide reef of rather open and friable quartz, standing up as a crest on a hill top for about three-eighths of a mile, and nearly 80 feet above the general level of the slate country.

The western side of the quartz reef at its north end is stained with carbonate of copper, its numerous caverns being conspicuous from a long distance owing to their bright green colouring. Traced to the south the whole hill is seen to be a belt of copper lodes, generally running parallel to the dominant quartz reef, but sometimes running out obliquely from it, and abutting against parallel veins of quartz. We saw a good deal of green carbonate of copper, often radiated and fibrous, and of the highest possible percentage. We could also knock out or pick up on the hill side, or in the gullies, heavy boulders of red oxide of copper and grey ore.

The Argylla property will take a large sum of money to explore. No company without very considerable capital should, in my opinion, attempt the task, but I believe the expenditure would be richly repaid. The green-painted caves in the quartz, I have no doubt at all, represent great bunches of ore which have been denuded.

The Argylla ore would come down to the railway by the valley of the Dugald. Supposing the railway to cross the Dugald near the copper and lead mines, the distance from Argylla to that point would be about 45 miles. Or the ore might possibly come down the Cabbage Tree Creek valley to the west; but that would naturally depend on the course taken by the trunk line. Mr. Henry has taken a loaded dray from the Leichhardt to Argylla *via* Cabbage Tree Creek. The track down the Dugald is quite practicable, either for road or tramway.

On the divide between the Dugald and Argylla Creek waters, Mr. Henry pointed out a hill (about a mile north of his dray track) where he had found manganese ore.

After returning to the Mount Euri Camp, on the Dugald, we kept Mr. Henry's dray track, which, after emerging (in three miles to the ESE.) from the narrow valley, runs northward towards Cabbage Tree Creek. In eight miles to the north we camped on the Portal Creek branch of the Dugald. Our course for the greater part of the northward journey lay through granite country. As in its general features this country resembled the stanniferous district at the head of the Walsh River, I prospected for tin after we had camped; but found only "nuggety" specular and magnetic iron in the wash.

At this camp we left the dray track and followed the river down, passing out of the mountains about two miles ENE. of the camp by a gorge (slate and greywacke striking north and south, with much specular iron strewn over the ground); then after travelling NE. through open timbered country and well-grassed plains, fringed with gidya, we struck in about six miles our former track up the Dugald at the "singularly barren piece of bare rocky country," about 11 miles from our camp, near the copper and lead mines.

After emerging from the gorge, we saw on the left some mountains capped with a horizontally-bedded rock, probably desert sandstone.

On the 28th of October we travelled down the right bank of the Dugald for about five miles, part of the way through granite country, and camped beside a mob of Mr. Henry's horses which were spelling under charge of a blackboy. At this camp we saw some cabbage-tree palms, the first tropical vegetation we had seen. The blackboy was sent back in the afternoon to the camp we had left in the morning, and brought a message from the party who were following with the waggon and horses.

The following day we crossed (WNW.) from the Dugald to the Leichhardt, a distance of about 10 miles. On the divide were some ridges of slate and sandstone (vertical, with a strike to NNE.), intersected by large quartz reefs and "blows" of hæmatite. About a mile from Cabbage Tree Creek we passed on the left a tower-like mass of hæmatite standing up 20 feet high.

Crossing Cabbage Tree Creek (an unimportant dry water course) we held northward by its left bank for eight miles, and camped at Walsh's station on the Leichhardt River, about two miles above its junction with Cabbage Tree Creek. The country down Cabbage Tree Creek was level, and fairly grassed with a few gidya and other trees. The soil was a light sandy loam.

The other members of the party arrived at the same camp at dusk. On the following day we again left them, to visit under Mr. Henry's guidance some mines to the west of the river.

We

We followed Mr. Henry's dray track for about six miles to the NW. when the road began to rise into broken country—black hornblendic slate, and sandstone altered to greywacke—vertically bedded and striking north and south with enormous "blows" and reefs of quartz.

In three miles more the road turned more to the west and ascended a valley, on the south side of which was a mountain capped with a gigantic quartz reef (east and west) weathering into fantastic shapes. On the north side of the valley was a similar, though smaller, reef. Narrower reefs ran across the valley in every direction between the two dominant reefs; often standing up like ruined masonry. By a gap, we passed westward into the valley of an affluent of Sunday Creek, the same features continuing. In one place I counted five quartz reefs crossing at a single point, and near this I observed an outcrop of copper ore.

A mile further, the *Crusader Copper Lode* (12 miles from Walsh's camp) stands up boldly above the surrounding country. Its matrix is quartz, which can be seen from a distance to be stained green with copper ore. The lode runs north 40 degrees west and is about 50 feet wide. On the surface and sides are large masses of copper ore and gossan. I broke out some fair samples of red oxide, malachite, and grey ore. The ore is more intimately mixed with silica than is usual in this district. A cutting has been driven into the NE. side of the lode for a distance of about 15 feet. Besides copper ore, the cutting shows a large quantity of specular iron in a matrix of pale green talc. The association, in the same lode, of copper ore and ironstone, is suggestive, considering the number of enormous outcrops of ironstone which occur in the district.

Four miles to WNW. (after crossing Sunday Creek and Dobbin's Creek, which unite to form a pretty large tributary of the Leichhardt) we came on *Dobbin's Lode*. It runs north and south, and is the continuation, on low ground, of a large quartz reef or ridge which stands up at its south end. The lode is about 15 feet wide. It shows a promising gossan of green carbonate of copper mixed up with quartz. Our visit was made within an hour of sunset, and we had to hurry on, as the nearest water was six miles off. I much regretted having no more time to bestow on these interesting mines, as I could not help thinking that many of the quartz reefs in the district were just as likely as the Crusader and the Dobbin to become locally metalliferous lodes.

Fourteen miles NNE. of Dobbin's Lode we recrossed the Leichhardt. At the crossing, Mr. Henry left us. We ran the Leichhardt down on the right bank to Kamilaroy, a distance of 18 miles. Here we were rejoined by the other members of the party, on the afternoon of 1st November.

Mr. Curr, the managing owner of Kamilaroy, informed us that he had obtained "colours" of gold in a small affluent of Dobbin's Creek in granite country, and that copper lodes occur in the valley of St. Paul's Creek, a tributary of the Leichhardt, west of Dobbin's Creek.

At Kamilaroy and the "Grass Gunyah," 12 miles to the south, we observed extensive outcrops of magnesian limestone. At Kamilaroy, the limestone yielded specimens of shark's teeth, echinus spines and plates, belemnites, mollusca, &c.,—enough to prove that it formed part of the "downs" formation, the same which extends from Cloncurry to Hughenden.

Thirty miles below Kamilaroy we passed Lorraine station (Brodie's). We crossed the Leichhardt for the last time, 6 miles below Lorraine.

The Leichhardt is a very large river, which rises nearly 100 miles south of where it is shown on the map. Its head overlaps that of Wills' Creek. The river has chains of large waterholes, which are sometimes connected by a trickle of water. There has been no rain now for eight months.

Down the right bank of the Leichhardt, so far as we traced it, the soil is a light sandy loam, and grows rich grass. The country is sometimes open and sometimes lightly timbered. From the Cloncurry, as far as our lowest crossing-place of the Leichhardt, there is a practicable route for a railway, over country which is not subject to floods.

Nine miles NW. of the Leichhardt, we crossed Sandy Creek. Between the two water-courses we crossed some low-lying "devil devil" country and blue bush swamps. As we approached Sandy Creek we saw a good deal of flooded land, with long "oaten grass," while the trees in the bed and on the banks of the creek itself bore the marks of most appalling floods.

Plevna station (Mr. Percy's) is situated on Sandy Creek, above the place where we crossed.

We struck the road from Normanton to Port Darwin, about five miles north from Sandy Creek, and kept it as far as Gregory Downs, on a general course of WNW. Sixteen miles after striking the road we passed Messrs. Scott and Gibson's station of Fiery Downs, on Fiery Creek. The first half of the journey was over country, not exactly liable to inundation, but probably covered in the wet season by a sheet of water, which is finally got rid of by evaporation rather than by drainage. Near Fiery Creek the country is flat, with grassy plains and gidya, but is apparently beyond the reach of all but very exceptional floods.

Between Fiery and Gregory Downs station (Watson Brothers'), the greater part of the region traversed by the road is open downs, though the downs can hardly be described as "rolling." The soil is dark, and ought to be fertile, but it appears to be sour from the stagnation of the water which falls on it in the form of rain.

ROBERT L. JACK.

THIRD REPORT.

On 9th November last, General Feilding left Gregory Downs to proceed to Point Parker, and, acting under his instructions, I returned to the Leichhardt by a route to the south of that by which we had travelled to the Gregory.

My plan was to run up the Gregory valley some distance and strike for the junction of the Leichhardt with Cabbage-tree Creek, so as to be enabled to judge (firstly) whether there was any promise of a mineral traffic arising from that district; and (secondly) whether the construction of a railway there would be practicable.

The

The first day's journey was uninteresting and monotonous, being (by the Rocklands road) either on the level downs, or on the alluvial flats or sand-ridges of the river. The sandy ridges were pretty well timbered with gum, bloodwood, and Moreton Bay ash, the latter rather larger than is usual in this district. We camped on the Gregory, 14 miles from the station, beside a yard and a tree marked broad arrow over ADI over W over VI in tablet. (Camp 1.)

On the 10th we continued our journey up the valley of the Gregory. Four miles from the camp a little hill on the eastern side of the road showed some beds of fine-grained hard blue limestone, and fine-grained hard siliceous flagstones, dipping to the west at 70 degrees. A few miles to the east a low range was observed, in which the successive outcrops of upturned stratified rocks, having a north and south strike, was very noticeable. Half-a-mile further a second little hill was seen on the western side of the road, with limestones and flagstones, dipping at 75 degrees to the east. Between this hill and the river, the strata rolled over again and dipped to the west.

At the south end of the hill a little work has been done on a small quartz reef, which coincides with the bedding of the rocks (north and south). A little "tile ore" and green carbonate of copper is mixed up with the quartz, but I should not expect the deposit to be present in payable quantities.

Between this hill and the range to the west the whole valley is not more than half-a-mile wide, and the river is confined to a single channel, about 50 yards wide and very deep.

About 27 miles above Gregory Downs the range comes close to the right bank of the river, and is composed of fine-grained buff-coloured sandstones (on which I noticed annelid tracks), dipping at 30 degrees to ESE. To the south I saw a long stretch of hills of similar structure. Looking up the valley I could distinctly see the dip reversed on the left bank of the river. Between the range and the river is a long lagoon, which overflows into Police Creek, near its junction with the river. There had been heavy rains here shortly before (probably on the 7th), as the ground was still boggy and Police Creek had been running strongly.

Above the mouth of Police Creek, the hills approach close to the river on both sides, and the "strangulation" of the river evidently gives rise to great floods. Judging from the marks on the trees, the road must be fully 25 feet under water in times of heavy rain. At this point the sandstones and shales have undergone a greater degree of metamorphism than is usual here, the former being altered to quartzites, and the latter to slate, lydian stone, and flint.

On emerging from this defile, the road turns SSW. and keeps well out from the river, crossing open grassy plains for about 10 miles, till it enters the valley of an insignificant watercourse, which it runs up, in a south-westerly direction, for about 6 miles.

Near the mouth of this valley, and 100 yards north of the road, I saw a gossan outcrop running north and south in slate country. This gossan, although it contained no visible ore, except of iron, was sufficiently promising to suggest a more minute examination of the locality if I could have spared the time, but night was coming on, and the road had taken us far from the river, so that our first anxiety was to obtain water for the horses.

At the head of the valley the road dropped into the valley of the O'Shannessy, and took a north-westerly direction across an open plain. Here we saw some natives, who ran away.

As it shortly became so dark that we could no longer see the road, and our horses were tired out, we were under the necessity of camping in the open plain without water. We had not filled the water bags, as I was under the impression that the road kept close to the bank of the Gregory. About 11 o'clock, however, a thunderstorm burst on us, and rain fell in torrents for about three hours. Three inches of rain at least must have fallen, as the "billies" caught that amount of water, and the prospecting dishes were running over. (Camp 2.)

November 11th.—In the morning we found on continuing our journey (to the NW.) that we had been camped not more than a mile and a-half from the O'Shannessy River—a fine running stream of about half the volume of the Gregory.

On crossing the O'Shannessy the road turns to the north, and in three miles reaches the police barracks on Carl Creek. (Camp 3.)

The police station is situated on the right bank of Carl Creek, a fine rushing stream, which leaves the Gregory and runs into the O'Shannessy. As the two rivers join a few miles below the barracks, a large island is formed by the three streams. Mr. Shadforth's station is situated on the island nearly opposite the police barracks.

Behind the barracks is a large open plain, which is bounded on the south by cliffs of a hard, yellowish limestone, horizontally bedded. This limestone evidently occupies an old depression, and overlies (unconformably) the nearly vertical sandstones, &c., which form the staple of the formation prevalent in the district, and which rise on the right bank of the O'Shannessy to a greater elevation than the limestone. The summit of the limestone is a plateau, which, as I am informed, extends to Rocklands, under the name of Barclay's Tableland.

About 20 miles above Carl Creek, the Gregory, as a running river, may be said to rise, as the water gushes out there from beneath the limestone and begins to flow although the dry river bed can be traced back into the northern territory of South Australia.

November 12th.—I deemed it unnecessary to go into the limestone table-land in search of mineral country, more especially as, even if minerals should be found there, they would probably go by dray to Point Parker, if a port were established there. I therefore returned down the Gregory with the intention of striking south-eastward, from near the mouth of Police Creek. I took Armit's "short-cut," which crosses the O'Shannessy two miles from the barracks, and keeps nearly parallel to the Gregory.

After leaving the O'Shannessy, the track cleared two passes in the mountains, and got down into comparatively low country, and finally into open grassy plains. The rocks in the mountains were mainly sandstones, always hardened but rarely altered otherwise. Ripple marks were frequently observed on the sandstone. The "short-cut" is about 14 miles in length, and joins the dray track nearly opposite Horse Creek; near the junction of the roads the bridle path passes close by a hill, near which I observed some fragments of manganese ore. These I traced to a little knoll where there was a "blow" of the ore, but it was not clear in what direction the lode ran. There were large blocks of very pure psilomelane and some of wad.

We

We camped on the dray road about two miles from the outcrop of manganese ore at the place where the "strangulation" of the river has already been mentioned. (Camp 4.)

After we had camped, I made a tour round the hills south of the camp (on the left bank of Police Creek), and found (about 300 yards from the river) another outcrop of very pure manganese ore (psilomelane).

From this point, our route, as laid down on the map accompanying this report, will explain at a glance the nature of the country traversed, and the difficulties which prevented our steering a straight course as originally intended.

I have no doubt that an engineer could take a railway from the mouth of Police Creek to the junction of Cabbage-tree Creek, but the notes which follow will give some idea of the difficulties to be overcome. The line would certainly be a very costly one, and its construction could only be warranted by valuable inducements in the form of land or mineral traffic.

November 13th.—For four miles to the SE. our way lay through nearly level lightly-timbered country, with low isolated hills on both sides. Undulating strata of sandstone, and a few of limestone, composed the hills. Two miles from the Gregory we passed a hill on the right, on which I picked up pebbles of manganese ore (pyrolusite) and hæmatite.

At the end of the four miles from the Gregory we crossed Police Creek; it was dry, and had a wide, shallow, gravelly bed. Its flood channels covered about a furlong of ground.

On the right bank of the creek we found a very wide and high lode of quartz and peroxide of iron, running east and west.

For three miles more we kept a south-easterly course, with rather high hills on our left (sandstone and slate, with a WNW. strike). The greater part of this distance was over low stony ridges covered with spinifex grass. Slate beds seemed more numerous here than usual in this region, and the same may be said of quartz reefs.

After crossing the stony ridges above referred to we ran down a gully, from its head to the east, for half-a-mile. On the right bank of the gully I noted three large lodes of hæmatite and yellow ochre in a matrix of quartz. Near this point we crossed the gully, which took a southerly course, and resumed our journey to the SE. In about a mile we crossed some stony ridges, and after crossing a flat (to the east) for half-a-mile, we camped beside a little waterhole filled up by the rain of the 10th. (Camp 5.)

November 14th.—For two miles south-east of the camp we traversed stony flats, grassy, and timbered with small gum, bloodwood, and box, crossing a creek of the fourth magnitude which ran to the west. We then got on low hills covered with spinifex, and with higher hills to right and left. Half-a-mile through the ridges to the SW. we saw a quartz reef running east and west. The increasing size of the hills on our left hand made it more and more impossible to keep our intended south-easterly course, and we were glad to get south for two miles, when we found a creek of the fourth magnitude falling to the west.

For the next two miles we kept our intended south-easterly course, till we crossed a gully falling into the creek last-mentioned.

In half-a-mile (SSE.) we came to the right bank of a fourth magnitude creek coming out of the high range on the left. In the hope of finding a passage through the range by the valley of this creek, I led up it for half-a-mile to the east, but the valley narrowed to a gorge, and I halted the horses and ascended the range (about 800 feet), to have a look ahead.

The view was disappointing. I could see nothing but a broken table-land, very stony and rough, and utterly barren, but for the spinifex, which was much worse than no vegetation at all. The ranges appeared to get higher to the south. Its structure was simple—hardened sandstones, sometimes ripple-marked, and here and there altered to quartzites, with a general dip of 25 degrees to the west. The outcrops of the various beds of sandstone, presenting their escarpments up the creek, formed a series of dams, and I could see from the hills a chain of waterholes nearly a mile in length, probably all due to the late rain.

Returning to the point where we had first struck the creek, we turned northward, and after travelling for a mile and a-half in a narrow bottom between the high range and some low hills on the left, reached a creek of the fourth magnitude, which emerged from the high range, and breaking through the lower hills ran NW. We followed the creek down for about a mile till we found some grass, and an inky waterhole due to the late rain. Here we camped. (Camp 6.)

After we had camped, I again ascended the range. Its character was unchanged, and I could see that the broken table-land was at least fivemiles wide.

November 15th.—As some of the horses were now very weak, and two had lost shoes, it would have been impossible to take them across the range, although fresh, well-shod horses might have done it. The only course now open to us was to go northward till some opening to the east presented itself.

Returning up the creek on which we had camped, to the place where we had first struck it yesterday, we turned to the north in this direction. After threading our way among stones and spinifex for about four miles between the range and the lower hills on the left, we had the satisfaction of seeing that the country became rather more open, and that the range began to dwindle. In half-a-mile to the north-east we crossed the range by a gap in a sandstone cliff, and got on the fall of Fiery Creek. It may be mentioned that where we turned to cross the range, we saw a well-built wet-season native hut, capable of holding half-a-dozen. A man could stand upright in the centre. It had a framework of saplings brought together at the tops so as to form a sort of dome, which was closely thatched with spinifex grass.

As soon as we had crossed the range we found ourselves at the head of a narrow grassy valley, falling between low hills, to the east. We kept the valley for about two miles, when the creek turned to the NE, and we left it, and steered again to the SE.

In one mile to the SE. we crossed a fourth magnitude creek running north.

The next two miles (to the east) were over stony ridges, on one of which I observed an outcrop of pyrolusite. We then ran down a gully, from its head, for three miles more to the east, till it fell into a large creek or river, with high mountains on its right bank. We ran the river down for about a quarter-mile to the NNE., and camped beside a large waterhole near a tree lately marked (by Mr. Bedford, licensed

licensed surveyor) broad-arrow over F over 74 in tablet. (Camp 7.) This "river" is Fiery Creek, and it seems here of much greater importance than it did where we crossed it before, some 40 or 50 miles lower. I should not expect to reach the head of Fiery Creek in less than 50 miles above the 74-mile tree. I do not think we saw two square miles of available country the whole day. The greater part was grassed with spinifex only.

November 16th.—As the range on the right bank of Fiery Creek was evidently too high to be crossed here, I resolved to go down the valley for some miles before striking eastward. We crossed to the left bank of the creek about half a mile below the camp. I have since learned that there is a cattle station (Mellish Park) on the creek, about a mile below our camp.

Two miles to the NNE. (with a hill on our right), we recrossed the creek.

Striking out from the creek to the NE., we crossed at two miles a fourth, and at three and a-half miles, a third magnitude creek. Up to the latter we had tolerable travelling, as we could generally avail ourselves of grassy hollows, though the ridges were stony and covered with spinifex.

The next two miles to the NE. were hard on the horses, as the ground was very stony. The range on our right had seemed impassable hitherto, but I now resolved to try a passage. The attempt, however, had to be given up, as my reconnoitring on foot disclosed the fact that what had seemed a breach in the hills was only the avenue to further ranges, intolerably stony and a mass of spinifex—passable only for fresh horses, all shod.

Three of the horses had lost fore shoes. One was knocking up, and another had got strange swellings on the back and head—caused, as I afterwards discovered, by his having got a gidya splinter in his back while rolling. I therefore resolved to return to Fiery Creek, and stop for a day to recruit the horses.

Two miles to the NW. brought us out of the hills. Here we saw four wet-season gunyahs; and in two miles more in the same direction across stony flats, with spinifex and turpentine brushwood, we reached the creek and camped. (Camp 8.)

The hills seen to-day were of the same character throughout. Sandstones and shales dipping to the NW. at angles varying from 10 degrees to 45 degrees—the sandstones sometimes hardened to quartzite. No quartz reefs.

November 17th.—While the horses were recruiting, we prospected in the creek, but could not get even "colours" of gold.

November 18th.—As the condition of the horses still forbade us to cross any more ranges for the present, we ran the creek down for about nine miles to the NNE. (crossing it several times) till after emerging from a gorge into comparatively open country, we were at last enabled to get round the end of the range.

As the creek has many fine lagoon-like waterholes, and the alluvial flats, though narrow, are well grassed, the banks of Fiery Creek are a favorite resort for cattle in the dry season. The river gums on the alluvial flats of Fiery Creek are unusually large, and might supply sleepers for a railway. The part of the range seen to day bears the same character as the part seen yesterday.

For six miles, in a general north-easterly direction, we skirted the base of the hills—the country rather poor and stony, with spinifex grass. The flats to the north, however, were evidently good grazing land. At the end of the six miles, we crossed the divide between Fiery and Sandy Creeks, and four miles to the east, across sandy-soiled country, fairly well grassed, and timbered with *melaleuca*, *bauhynia*, stunted bloodwood and occasional patches of brushwood, brought us to the left bank of Sandy Creek. We found this "creek" a river, though hardly so large as Fiery Creek. Like Fiery Creek, it was of more importance up here than it was where we formerly crossed it lower down.

From Sandy Creek we held straight to the east. At two miles we had the hills close on our right, but from this point they gradually receded from our course. At six miles we reached a creek of the fourth magnitude, which we ran up (to the SSW.) for half a mile, but as we found no water we continued our journey.

In a mile and a-half, ESE, most of the way, over crab-holed plains covered with rounded stones, and with little grass, we had to camp at sunset without water, on the edge of a gidyah scrub. (Camp 9.)

November 19th.—My intention now was to make for Lorraine station, where I could leave two spent horses to recruit, till Mr. Raff's arrival, and procure shoes for the others.

Two miles and a-half to the east we had to go south for half-a-mile, to round a scrub. In three and a-half miles further (course east 10 degrees south) we crossed a low gravelly hill. In eleven miles further to ESE. we camped on a little water (due to the late rain), on Myally Creek. (Camp 10.)

The creek was about twenty yards wide, with a sandy bed. We must have crossed Mittigoody Creek without noticing it, so that it cannot be a water course of much importance.

November 20th.—In about five miles to ESE, we crossed the Leichhardt River, and found ourselves about a mile and a half below Lorraine station, where we camped. (Camp 11.)

November 21st.—At Lorraine, I was so fortunate as to meet Mr. C. Bedford, licensed surveyor, whose knowledge of this part of the Gulf country is extensive and reliable. I spent the day in reducing from his maps, while the men were shoeing the horses. The map which accompanies this report is based on Mr. Bedford's surveys, with my own traverses and observations sketched in.

November 22nd.—Travelled by the road about fifteen miles up the Leichhardt, and camped at a deep waterhole between the 60 and 61-mile trees. (Camp 12.)

The channel of the river is at its narrowest here, and I have seen no other place so favourable for a railway crossing the river.

November 23rd.—About three miles further up the river we crossed it, just at the mouth of Gunpowder Creek, and for the rest of the day ran the latter up.

For the first ten miles, Gunpowder Creek is the very counterpart of the Leichhardt River, both in size and character. Higher up, the bed of the creek becomes shallow and diffuse, with a gravelly bottom and lagoon-like waterholes, surrounded by evergreen sweet grass. The land on both sides of the creek is level and well grassed for the first 14 miles, and bears a strong resemblance to the country near Lorraine.

About

About nine miles from the mouth of the creek, a limestone was observed on the left bank, very like that of Kamilaroy. It was full of small fish-teeth, fragments of chelonian plates and belemnites, with a few shells. I saw one minute ammonite.

At the Twelve-mile tree (the marked trees count from the mouth of the creek upwards—Mr. Bedford's furthest is 24 miles up) the banks resounded with the note of millions of black cockatoos. We camped by a waterhole near the 14-mile tree. (Camp 13.) The flood-bed of the creek (or river) here is about three-eighths of a mile wide.

November 24th.—At sunrise we continued our journey up Gunpowder Creek. At eighteen miles from the mouth of the creek we passed an innumerable army of flying foxes camped, head downward, among the tea-tree scrub by the edge of the river.

At 20 miles the country began to be rocky; and leaving the men to find easier travelling for the packhorses by the bank of the river, I kept well out among the low hills. These were composed of nearly vertical beds (striking SW.) of hard siliceous grit and ferruginous slate, with many small quartz reefs.

About 26 miles from the mouth of the creek we camped on a lagoon in the bed of the river. We found a tree marked TC over 78 on the right bank. (Camp 14.)

After we had arranged the camp, we visited the hills about a mile distant from the right bank of the river. The hills are capped by a very large quartz reef (north and south), which stands up like a wall to a height of 50 feet. The reef sends out numerous branches in all directions. In the large reef I saw a single speck of carbonate of copper. We packed down to the river some dirt from a gully which must receive a large proportion of the wash from the reefs; but were disappointed to find no "colours" in it.

Gunpowder Creek is very little known. In fact, I doubt if anybody has followed it much further up than our Camp 14; but I believe it must have a course nearly as long as the Leichhardt itself. I think I mentioned in a previous report that the Leichhardt goes much further south than is shown in the published maps; even overlapping Wills' Creek.

25th November.—On leaving Gunpowder Creek we struck SE. for a gap in the hills where we had prospected yesterday. In about a mile and a-half we cleared the gap (having crossed on the way a third magnitude creek falling to the north-east). Beyond the gap we found slaty ridges the slate having a north and south strike with quartz reefs.

Five and a-half miles ESE. from the gap, we crossed a third magnitude creek—in all probability Spring Creek—which falls into Gunpowder Creek, eleven miles from the mouth of the latter. I should have been glad to camp here and prospect; but after a search we could find no water, and had to move on.

Between Gunpowder and Spring Creeks the country was open and fairly well grassed. The remainder of the day's journey lay through a waste of spinifex and angular boulders.

On the right bank of Spring Creek were some low hills of reddish weathered slate. Here I found a vein of specular iron ore, and a quartz reef, seven inches wide, running north and south, through a greenish chlorite-stained country of slate and quartzose greywacke.

A mile and a-half east of Spring Creek I saw, in hardened white sandstone or quartzite country, occasionally chloritic, some gigantic north and south quartz reefs. Near the reefs were some diorite blocks, probably derived from a dyke.

One mile more to the east we struck a fourth magnitude creek, running to the north to join Spring Creek. On its right bank was a cluster of about a dozen native huts or gunyahs. We crossed the creek twice, and bore away to the SE. for four miles between two ranges of fine-grained white hardened sandstone or quartzite. The range on our left was the higher, and until we should find some gap in it there was little hope of getting away to the east.

A mile to the south I thought I had found such a gap, but instead of dropping down on the eastern fall, we found ourselves only at the head of a gully which fell to the west, probably to join Spring Creek. We followed it down for half-a-mile and then got away for half-a-mile to the south.

The range still presented an unbroken wall on our left (and whenever I ascended it on foot I could see no chance of getting the horses across, as similar stony ranges extended eastward as far as the eye could reach), and now forced us for a mile and a-half to SSW. across slaty ridges (with a high hill on our right) to a creek of the fourth magnitude, running WNW.

We had travelled through similar country for two miles to the SSE., one and a-half mile to the south, and one and a-half to the SSE., still hoping to get away to the east, and always meeting with disappointment, when we had to give up the attempt for the day. Retracing our steps for half-a-mile, we ran down a gully to the SW. for a mile till it fell into the left bank of a fourth magnitude creek, where, to our unspeakable joy, we found water, as well as grass, for the horses. I had quite expected a waterless camp, and had made up my mind to make a forced march next day back to GunpowderCreek, as it might have been disastrous to have chanced the crossing of the range with thirty horses as weak as ours now were.

November 26th.—As yesterday had been a very trying day for the horses, and several required shoeing, I thought it prudent to spell them here for a day while I reconnoitred the way ahead.

Accompanied by Wiederkeln, I went out to solve the problem of an "easterly passage." Our first surprise was to find that the creek fell into the left bank of what might fairly be termed a river, only a quarter of a mile below our camp. Our next, and much greater, was to find that this river, coming from the comparatively low country on the west, ran full tilt at, and breached through the range which we had vainly tried to cross. It had a rocky bed, with magnificent waterholes. It ran to the south for about a mile, when it was met by a large tributary coming from the south. It then entered the range by an incredibly narrow gorge and forced its way to the east. We had to leave the river above the gorge, and after circling round by the hill-tops on the left bank of the tributary, cross the latter (large waterholes and rocky, impassable gorges) and ascend the hills on the south side of the river—a journey of about six miles—before we could regain the river, about two miles below the first gorge. We crossed the river at a very romantic spot. On either side a little patch of green had been formed by the mouths of tributary gullies, while both above and below, the river contracted to a cañon, with, apparently, unfathomable depths of blue water standing between precipitous walls of rock. This, one of the most picturesque scenes in Australia, can, however, have been rarely visited by white men.

I had

I had seen so few traces of the aboriginal inhabitants of the soil between the Gregory and the Leichhardt that I had frequently asked myself the question—"What does he do with himself?" But from what we saw to-day, I have no doubt that this cañon is one of his chosen haunts.

From the river we returned in about three miles over stony hill tops to the camp.

The whole of the hills we saw to-day—and I believe they are a fair sample of the range generally—are of white sandstone, nearly vertical or dipping slightly to the west. They are hardened, but not otherwise much altered.

For to-morrow I can see no better course than to cross the hills north of the gorge, and to drop down on the river, below the place where I could see it apparently escaping from the range for the last time and running to the NE.

November 27th.—We carried out the plan referred to yesterday—if it could be called a plan. By 11 o'clock we had accomplished about five miles of the very roughest possible travelling in a general ENE. direction, over hill tops and gullies, and found ourselves on the left bank of the river, in open country below the last of the gorges.

After a halt to refresh the horses, we ran the river down for about three miles in a general ENE. direction till it had got clear of the hills on the right bank, when we left it, and struck for the Leichhardt.

This river must be Mistake Creek, which falls into Gunpowder Creek about three miles from the junction of the latter with the Leichhardt.

After about seven miles of travelling to the east, through open, well-grassed country, we crossed a low divide, crowned with scrub. Two miles further we crossed Eureka Creek, and ran it down for a mile to the NE., but finding no water, left it, and reached the Leichhardt in one mile more to the east (Limestone Downs). We camped on the river near the 31-mile tree, about two miles below the grass gunyah referred to in my last report.

I may say, in general terms, that I was not favourably impressed with the chance of mineral traffic for the railway arising from the country I had traversed between the Gregory and the Leichhardt. I do not doubt that the strata are of the same geological age as those of the Cloncurry, Dugald, and Upper Leichhardt, but pure siliceous sandstones bulk too largely in the ranges. The slates are, as a rule, not ferruginous enough. Quartz reefs are too rare, and the intrusive diorites and vast deposits of ironstone which characterize the Cloncurry district are conspicuous by their almost entire absence. In a word, the strata have not undergone a sufficient degree of metamorphism to render them very highly metalliferous.

Had there been time enough at my disposal, however, I could have wished to examine more minutely the district between the O'Shannessy and Police Creek, as well as the country from the left bank of Gunpowder Creek to the heads of Spring Creek. In the first-named district, the numerous outcrops of manganese ore, and occasional appearance of gossan, at least warrant further search for other metallic deposits. In the other region, the prevalence of ferruginous slates, the frequency of quartz reefs, and the occurrence of specular iron ore, led me to believe in the presence of gold, and possibly of ores of other metals.

November 28th.—We travelled by the road up the Leichhardt to Cooloolah (Mr. Collis' station), a distance of 22 miles. Another of the horses is now scarcely able to walk, and as we have no spare horses, the failure of one implies the overloading of another.

The road traverses good open pastoral country up to Cooloolah. A range, however (of which a hint is given in the published map, in the single peak named Mount Dromedary), is visible a few miles to the east.

November 29th.—At Cooloolah we rested the horses for the day; I expected besides to be able to buy some fresh ones from Mr. Collis, but was disappointed in this, as he failed to find the horses he proposed to sell.

November 30th.—Left Cooloolah. In nine miles the road, which had followed the left bank of the Leichhardt, crossed the river at the mouth of Cabbage tree Creek, and ran up the right bank for a mile and a quarter to our old camp, beside Mr. Walsh's station. As there was no water between the Leichhardt and the Dugald—a distance of 20 miles, we gave the horses four hours at the Leichhardt.

For four miles from Walsh's station the track goes SSE. till it crosses Cabbage Tree Creek, when it strikes about 10 degree south of east. For the first 12 miles we crossed low ridges—quartzite, porphyry, and slate, with a good deal of quartz.

This country extends northward (*via* Mount Dromedary) for a long distance between the Leichhardt and Cloncurry Rivers, and has never been prospected, as far as I can hear.

The last eight miles to the Dugald were over open country with "plains," evidently belonging to the "downs" formation.

Two of our horses were knocking up, and but for the kindness of Mr. Bell, a rheumatic invalid, who was travelling with us from Cooloolah to Cloncurry, in allowing his packhorse to carry some of our load, I doubt if we should have reached the Dugald.

At the Dugald (about two miles below Mr. Walsh's station), we got water in a hole in the sand which had been excavated by a bullock scoop.

December 1st.—It was my intention to have pushed on to-day to the Williams River (20 miles), so as to catch the mailman to-morrow at Fort Constantine, and communicate with General Feilding. When we got to Middle Creek, however (10 miles east 10 degrees south), it was evident that our horses could go no further. Luckily there was water in Middle Creek. In the afternoon there was a terrific gale, with thunderstorm and hailstorm.

The hail lasted for some minutes, and the stones were as large as marbles—a very unusual experience in the tropics.

December 2nd.—Mr. Bell having kindly lent me his own horse, I pushed on to Fort Constantine, leaving the men to bring on the packhorses by easy stages. In 10 miles (east 10 degrees south) I reached Clonagh, Mr. Reid's station, on the Williams River. The banks of the Dugald Middle Creek, and the Williams, exposed sections of specular and calcareous sandstone, with echinus spines, etc. The country from the Dugald to the Williams is good enough to carry sheep if dams were provided.

From

From Clonagh I steered across the bush to the SE., and in five miles struck the Cloncurry River. Keeping the right bank of the river, I reached Fort Constantine in about 20 miles.

I arrived at Cloncurry (18 miles) on the following day (3rd December). The packhorses covered the distance (50 miles) from Middle Creek to their old camp at the Cloncurry in four days, and arrived on 5th instant.

ROBERT L. JACK.

Cloncurry, 8th December, 1881.

FOURTH REPORT.

GREAT AUSTRALIAN COPPER MINE. LODE A.

The most conspicuous feature of the mine is the outcrop of a lode, which runs north 33 degrees west, and stands up to an average height of about 20 feet above the general level, for about 80 yards. The lode underlies to west 33 degrees south, at an angle of 50 degrees. The matrix is a brownish quartzite, very tough and hard, and frequently enclosing small pieces of native copper, interspersed through the matrix irregularly, but as a rule, in veins parallel to the general run of the lode, are masses of green carbonate of copper and red oxide, the latter often in crystals, and as nearly as may be, chemically pure. The ore has been quarried to a small extent on the crown and south-western side of the hill. If the whole hill were quarried out I believe that on a rough estimate quite a fourth of the entire mass would yield ore containing 35 per cent. of copper and over, after the rejection of the siliceous matrix and portions of ore too much mixed up with the matrix.

At the SE. end of the hill the A lode is shifted about 90 feet to the SW. by a cross lode (B) whose course is east 40 degrees north. This cross lode is traceable for over 100 yards to the NE. of the lode A, but the first 20 feet or so are obscured by a talus of debris from the outcrop of lode A. Lode B is nearly vertical, but underlies a little to north 40 degrees west. Its most conspicuous feature is a rock, 32 feet in length, 8 feet broad, and averaging 6 feet in height. This rock is a mass of quartzite like that which forms the matrix of lode A, and has joints and pockets coated with green carbonate of copper. To west 40 degrees south of the rock and in the same line, the cap of an ironstone and copper lode extends for 17 feet, when it passes under the talus already referred to. At the other end of the rock (to east 40 degrees north), the lode is traceable, either *in situ* or in blocks, for 260 feet. Lode B occurs in a line of fault with a downthrow to the north, and is of later date than lode A.

To the south of lode B, lode A is continued in a general direction of south 10 degrees east, for a distance of about 24 yards. It appears here to be narrower and poorer (at the outcrop) than on the other side of the cross lode, and to bifurcate towards the south end.

The south end of this (which may be called the second section of lode A), is intersected by a second cross lode (lode C) running east 35 degrees north. This lode has been worked open cast for about 110 feet to east 35 degrees north from the crossing of lode A. The ground rises in this direction, and the present face of the working is about 20 feet high. The lode varies from 2 to 12 feet in width and is nearly vertical. The faces and sides of the workings expose masses of red oxide of copper of great purity, often intimately mixed with small nuggets of native copper. Occasional crystals of black oxide of copper are met with in this cutting. The oxide is traceable for a considerable distance beyond the working.

What may be called the third (3rd) section of lode A extends in a general direction of south 15 degrees east from lode C. It has been worked open cast for about fifty feet from the crossing of lode C, and has yielded much rich ore. The south face of the open cast shows a mass of very pure red oxide bound together by masses of native copper.

From this open cast no work has been done for the next nineteen feet, (though the lode is visible on the surface) when an underlie shaft has been sunk on it, in rich ore. The lode is untouched for about forty feet from the shaft, when it is again worked open cast for a distance of ninety feet. The workings here have tumbled in, but enough is still seen to prove that the lode continues undiminished in size, and yields rich oxide ores.

About 250 yards to the SE. of this cutting is Mount Pisa, a hill of iron ore, very like that of Mount Leviathan (see first report), although not rising into such an enormous mass.

About two miles north of the Great Australian is a group of copper lodes, which I think are destined to become of more importance than they seem at present to be considered. They occur on the crown of a little spinifex-covered hill. The main or central lode runs NE. and SW., pointing in the latter direction to Mount Leviathan. It may be remarked here that this case, the relation of the Great Australian lodes and Mount Pisa, and many other cases in the district, suggest that an intimate connection exists between the copper lodes and the ironstone mountain masses.

The main or central lode begins (so far as can be seen) at its NE. end, in a knob of tough quartzite, very like the matrix of the Great Australian. The knob is about twelve feet high, and is coated on joints and faces with green carbonate of copper. From the knob the cap of this lode is visible for 293 yards to the SW. It generally presents the appearance either of a quartz reef, or of a breccia of quartz and hæmatite, with some green carbonate and lumps of red oxide of copper. About 120 feet from the knob a shaft has been sunk to the depth of about thirty feet. The lode has a slight underlie to the NW. About two tons of ore are lying at bank, including some good red oxide with native copper, some grey ore, and a little copper pyrites.

Some 323 feet from the SW. end of the main lode, a second lode branches off on the SE. side. It forms a very acute angle with the main lode, being only sixty feet distant from the knob at the end of latter (bearing south 15 degrees east), at the point where it is last seen. The cap differs very little in character from that of the main lode.

150 feet

156 feet north 30 degrees west from the junction of the two last mentioned lodes, a third lode commences. It is traceable for 230 feet to east 10 degrees north. Its cap is a breccia of quartz and ironstone with a few stains of green carbonate of copper. Three other lodes occur to the north of this. Two of them run WSW., and the third NE. They are masses of tough buff-coloured quartzite, varying here and there to ferruginous and quartzose lodes, with lumps of green carbonate of copper and some grey ore. The lodes on the NW. of the central lode, in all probability join the latter to the SW. of the knob.

Rockwood, 15th January, 1882.

FIFTH REPORT.

THE GILDED ROSE GOLD MINE.

Lies at the head of Bishop's Creek, about eight miles east of the Cloncurry Native Police Camp The reef runs east 10 degrees south, and underlies to south 10 degrees west at 75 degrees. It is traceable for nearly half a mile. Its line coincides with the strike of the bedded rocks which occur in the immediate neighbourhood—viz., flaggy talcose sandstones and shales. The quartz occurs in blocks of from 10 inches to 3 feet across, and is coated and veined at the surface with iron peroxide and limonite. From the lower levels (which I was unable to visit owing to the stoppage of the works, and consequent accumulation of water), large quantities of pyritous mundic have been mined, and the stone is said to yield 2 oz. of gold to the ton. The mine has been registered since 25th November last, to enable the proprietors to obtain machinery. The present plant is certainly very imperfect.

The greater part of the space from the Gilded Rose south-westward towards Snake Creek is occupied by a low range of slate and greywacke rocks, with at least one thick bed of grey crystalline limestone, containing chloride, and weathering black. These rocks have a general strike to the NNW. They are intersected by numerous quartz reefs and leaders, some of which, I believe, would pay well to work.

Mount Norma lies about ten miles SE. of the Gilded Rose. It is a very conspicuous hill, especially as seen from the Hughenden road. It is of vertical slate (or rather shale) with a NW. strike, and is intersected with reefs or veins of quartzite. On its eastern side is the Mountain Home Copper Mine. The mine is on one of the quartzite reefs above referred to, which runs NNW. and is almost vertical, but has a slight underlie to ENE. The reef is seamed with copper ore, especially in the back (up hill). In the upper part of the lode, where the reef stands up like a wall on the hill side, the copper ore is represented by stains (stalactitic coatings) of green carbonate. The lode is a peculiar one in many respects, from the association of minerals. It yields green carbonate of copper, ferruginous red oxide of copper, enclosing numerous garnets, asbolane (manganese and cobalt) and numerous dendritic markings in binoxide of manganese.

From the hardness and toughness of the siliceous matrix of the ore, the Mountain Home will probably be an expensive mine to work, but I should expect it to have a large output of ore of good quality. The labour conditions necessary for securing the land have been fulfilled for the most part by the construction of a dray road up the hill; and the mine is very little opened out.

From the summit of Mount Norma, horizontal outliers of "desert sandstone" are seen to extend from the Soldier's Cap (six miles SE. of Mount Norma) north-westward towards the Cloncurry.

I was much struck by the aspect of the country between the Gilded Rose and the Mountain Home. The rocks were of sedimentary origin—mainly quartzite, bluish hardened quartzoze greywacke, and dark slate, with occasional diorite masses. They were full of quartz reefs, and blocks of black ironstone were everywhere scattered about. On breaking some of these boulders, about halfway between the Gilded Rose and Mount Norma, I found them to be masses of green carbonate of copper enclosed in an envelope of black ironstone. I expect that many copper lodes and auriferous reefs remain to be discovered in this district.

On Weatherley Creek, about three miles north of the Soldier's Cap, a reef is being worked. Its matrix is quartz and calcite. There is no machinery on the ground at present, but the rubble of the casing of the reef yields 2 oz. of gold to the ton steadily, and the owners are doing very well. When machinery arrives several other reefs in the neighbourhood will be taken up and worked. I did not visit Weatherley's Reef, but the above particulars are given on what I believe to be reliable authority.

Elder Creek rises at Mount Norma, and runs north-westward into the Williams River. Six miles down the creek some good prospects of gold have been obtained in gullies falling into the left bank.

On making inquiries as to water between the Cloncurry and Winton, I learned that the country was about at its worst, there having been no rain for nine months except in very local showers. The usual route up the Gilliatt River and Mackinlay Creek to Beaudesert, and thence to Belkate on the Diamentina, was practically closed for the season. I determined to go by Eastern Creek, where there had been some little rain.

We had camped on the night of 20th December on the Gilliatt River, where it is crossed by the Hughenden road. The waterhole had fallen to a puddle, about 10 feet in diameter, and when we arrived we found it in possession of a large mob of cattle. After the water had been boiled twice, and skimmed and decanted, it was good enough to make tea with.* The horses, however, could not be expected to like it, and on the 21st, five of them were missing. They were not found till four o'clock. I thought we could reach the 8-mile waterhole on Eastern Creek (distant about eight miles from our camp) before dark. We struck Eastern Creek, just after sunset, about two miles below the 8-mile hole. In creeks in the "downs" it is very hard to tell which is the main channel, and we unfortunately selected one of the mouths of a tributary called Sadowa Creek. Finding no water in this, and in the belief that we were running up Eastern Creek, we followed Sadowa Creek, for $9\frac{1}{2}$ miles in the dark, when we had to camp (at eleven o'clock at night) without water.

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* Some notes are introduced which are not strictly geological, as I fancy that a true picture of the state of the western interior at the end of a dry season must possess some interest for the promoters of the railway.

In the early morning of next day we packed up and retraced our steps. We found in Eastern Creek, a little above its junction with Sadowa Creek, a waterhole (surveyor's tree, broad-arrow 33), which we afterwards found out to be the lower part of the 8-mile hole, but far separated by the drought from the upper part. The hole was very small. The water could not last another week, and a wide border of treacherous clay surrounded it. A large mob of cattle were crowded on the banks, but the animals only ventured in, one by one, after they had become fairly maddened by thirst. Then they had a struggle for life in getting out. Four head of cattle were hopelessly bogged—alive, but drowned to death. We tied all the horses up, and watered them with the tin dishes.

We had next to run Eastern Creek down (eight miles) to Edington station, which was the nearest place where water was certain, and we did not dare to camp the horses beside the boggy waterhole.

On the 24th we again started to run up Eastern Creek. We found the 8-mile waterhole to be about two miles above the boggy hole at the 33-mile tree. In the latter, four more cattle had got bogged.

Thirteen miles further we passed another waterhole, but it was far too boggy to water the horses. In five miles more we camped on a little waterhole (near the 53-mile tree) apparently due to recent rain.

On Christmas day we passed a waterhole at 2½ miles, but it was dangerously boggy. At 5½ miles and 11½ miles we passed two waterholes with stony bottoms and quite safe. At 20½ miles we camped on a fourth waterhole.

The next day (26th) we followed the creek up for 19 miles without seeing any water, when, as the heat was terrible, and one of the horses was knocking up, we camped for a time. All the water we had seen in Eastern Creek above the 8-mile hole had been due to recent rain, which had apparently not extended beyond the limits of our yesterday's journey.

After seven more miles of travelling, mainly south—the creek having in the meantime run out—we camped (still without water) on the open downs to rest as several horses were now quite exhausted. We packed up again just before sunset, and in ten miles reached the Diamentina, and camped on a waterhole about a mile and a-half below Kynoona.

The strata met with between Edington and Kynoona appeared to be on the whole horizontal, and consisted of grey and buff sandstones, grey shales and cone-in-cone limestone. The latter became more and more rare the further we travelled to the south. The sandstone sometimes contained echinus spines. The whole of the country was open rolling downs, quite bare of timber except in the beds of the creeks. The divide between the waters falling into the Gulf of Carpentaria and others which flow to the south was quite imperceptible.

The following day had to be devoted to mapping, while the horses recruited their strength.

On 28th December we followed the Diamentina down by the road on its right bank. We passed a waterhole at eight miles At 16 miles we passed a new sheep fence, remarkable as being at present the furthest west permanent improvement of the sort on the Upper Diamenitna.

At 25 miles we camped on a waterhole on the right bank of the river.

Kerr's Tableland, seen in the distance in the early part of the day, looked like slate with an unconformable capping of horizontal sandstone. Pinnacle Hill, Mount Cathedral, and the Giant's Table were seen, but the heat was intense, and the hills were so distorted by mirage that I could make out nothing of their structure.

The road kept for the greater portion of the day on the alluvial flats of the river. Whenever the rock was seen it was a soft grey or buff sandstone. Sometimes the ground was strewn with large little-rounded pebbles of tough quartzite—occasionally inclining to opalization—and smaller and better-rounded pebbles of sandy-brown iron ore. Quartzite of this variety occurs *in situ* in the Lancewood Range and the table-land east of the Landsborough. It is desert sandstone somewhat altered. The pebbles attest the denudation of the desert sandstone from vast areas where the downs formation now happily comes to the surface.

December 29th.—In six miles we passed a waterhole, and crossed the Diamentina at a waterhole the site of old Dagworth station. The present station is on the left bank of the river some miles further up. In five miles more we camped on a waterhole in Watt's Creek, near its junction with the Diamentina. A hut is being erected here for an out-station on Elderslie run.

In this day's journey sandstones predominated, and they became coarser in grain and greyer, towards Watt's Creek.

Grey sandy shales accompanied the sandstone. A little silicified wood was seen.

On the 30th, we travelled by the road from Watt's Creek to the Ayrshire Downs on Workingham Creek, a distance of 30 miles. There was no water on the road, but I was informed that some was to be found in the Lancewood Range.

Between the Diamentina and Workingham Creek the road passes over high open downs. The prevalent rocks were grey sandstones, with a good deal of sandy ironstone or ironmarked sandstone. A good deal of silicified wood was seen lying on the surface. A peculiar feature of the sandstone is the occurrence of spheroidal concretions of all sizes up to six feet in diameter.

The Lancewood Range consists mainly of a single thick horizontal bed of rock, partly gritty white hardened sandstone, and partly white hardened clay. It is a slightly altered outlying fragment of the desert sandstone.

December 31.—Accompanied by Mr. Glissan, the manager of Ayrshire Downs, and Mr. Mitchell of Werna,* I visited a well on the boundary of the two runs.

The well was sunk in 1879, to the depth of 204 feet, where it was stopped in a bed of fine-grained hard grey sandstone. The strata passed through were principally grey sandstones and sandy shales; a bed of argillaceous sandstone with shells was passed through, and lumps of silicified and carbonised wood were dug up from various depths. A first seam of coal, three or four inches thick, was cut at about 140 feet; a little water came in just below. A second thin coal seam was passed, somewhere between 140 and 180 feet;

* Werna Station is on Workingham Creek, 10 miles above Ayrshire Downs. In the Lands Office map, it is incorrectly ocated on Werna Creek.

1884.

QUEENSLAND.

REPORT

ON THE

HODGKINSON GOLD FIELD.

WITH TWO MAPS.

BY

ROBERT L. JACK, GOVERNMENT GEOLOGIST.

PRESENTED TO BOTH HOUSES OF PARLIAMENT BY COMMAND.

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1884.

REPORT ON THE HODGKINSON GOLD FIELD.

Two maps accompany this Report, and are intended to illustrate the structure of the goldfield. The first is a detail map, on the scale of four inches to a mile, of the central portion of the field. The second, on the scale of one inch to a mile, comprises the same area, and extends westward to the Union and eastward to Northcote.

After ascending from the coast flats near Port Douglas a slaty and schistose table-land extends, at an elevation varying from 900 to 1,800 feet, to Anderson's homestead, a few miles beyond the Mitchell. Then a sudden transition takes place, marked by an equally abrupt ascent, and "The Granite," or Hann's Table-land, forms a lofty barrier between the Mitchell and the Hodgkinson waters. Its general elevation is from 1,500 to 2,000 feet. It is only a few miles in breadth. It divides the slates and schists of the coast regions from the slaty formation of the Hodgkinson which forms the country rock of this remarkable goldfield.

It is possible that the same formation originally extended on both sides of the granite table-land. If so, the coastward portion has suffered metamorphism in a much greater degree than the inland portion. The latter unquestionably looks newer than the former, and if both existed side by side it is not easy to see how one escaped the metamorphism which the other underwent. The age of the coastward slates and schists, however, has not been settled, nor is likely to be without a more detailed examination than has yet been attempted. Let this question be settled how it may, the fact remains that the one region (very little metamorphosed and presumably the newer, if there really be any difference) is rich in auriferous reefs, while the other (highly metamorphosed and presumably the older), though far from destitute of quartz reefs, contains but a trifling amount of gold.

The stratified rocks of the Hodgkinson vary in fineness from shales to conglomerates. At the one end of the series the shales consist of pure blue clay, sometimes (as for instance at the Rob Roy mine) blackened by carbonaceous matter. The clay is divided into thin plates or laminæ by the planes which mark the pauses in the process of deposition. Slaty cleavage is not entirely unknown, but it is so rarely met with and so uncertain in its direction that it may be presumed that pressure of the sort which results in the production of cleavage has been very feebly exerted. Alternating with the shales are strata of greywacke, whose materials are essentially the same, but have not suffered comminution to the same extent. The greywackes bear to the shales the same relation which sand bears to mud. The component grains or granules are partly derived from a basic felspar and partly from a hornblendic rock. The felspatho-hornblenbic matrix contains minute flakes of mica and grains of quartz. The mica and quartz have apparently been derived from a pre-existing granitic rock. According to the frequency and size of the quartz grains, the greywackes pass by fine gradations into grits and conglomerates. The latter, however contain, in addition to quartz pebbles, pebbles of quartzite or hardened siliceous sandstone, porphyry, Lydian-stone, dark shale, and limestone.

By carefully noting the dip and strike of the strata wherever they appeared at the surface, in gully or on hill-top, and laying down their degree and direction on the maps, a clearer idea of the structure of the goldfield has been obtained than could have been arrived at by any other method. The different strata do not present such marked characteristics that they can be traced with confidence for long distances, although some of the conglomerates in Glen Mowbray have been followed for more than a mile. Conglomerates, however, are from their very nature—being the product of strong currents and powerful attrition—apt to be of very local occurrence.

Within the area embraced by the large scale map (the neighbourhood of Thornborough and Kingsborough) it will be seen that there is a marked connection between the geological structure and the physical features of the field. That this holds equally true of the outside districts, I have no doubt; but a study in detail of the whole district would occupy too much time, and would employ the use of maps which do not exist, and could only be made (like the maps attached to this report) with months of labour in the field.

By following the vermillion lines on the maps, it will be seen that the strata strike on the whole from north-west to south-east, their denuded edges coming to the surface in that direction. The dip is usually towards the north-east, and, at a high angle, approaching the vertical. But the lines denoting the outcrops of the strata, it will be seen, bend or "bag" southward along an axial line passing to the west of the township of Thornborough. It is impossible to estimate exactly the thickness of the series of strata to which the Hogkinson Goldfield belongs, as neither top nor bottom has yet been detected, and, moreover, the apparent thickness may be exaggerated by unsuspected replications among the denuded beds. But a minimum thickness at least may be arrived at with some confidence by assuming that, allowing for replications, and even for possible faults, the average dip to the north-east is no more than 65 degrees. On this assumption a thickness of 4,000 feet may be presumed for the strata cropping out between the vermillion line representing the horizon of the Amy Moore mine and the north-east edge of the large scale map as measured to the south-east of Kingsborough. Measuring downward from this same horizon at Peak "N," in the Mount McGann Range, south-westward to Mount Grant (a line where the apparent thickness is not affected by the bending or bagging above referred to), a further thickness of at least 17,000 feet of strata is met with.

The detailed "study in stratigraphy" which the preparation of the large scale map implies has revealed nothing to suggest the idea of any break in the continuity of the deposition of the whole series of at least 21,000 feet of strata, unless it be the gathering, at the head of Columbia Creek, of a portion of the series which, at the mouth of Caledonia Creek, only five miles distant, measures (at 65 degrees of estimated average dip) about 10,000 feet, into a space which can contain (although the strata are vertical) no more than 1,300 feet. But I am inclined to think that the phenomenon may be explained by a thinning out of the sediments towards the south-east, though possibly the effect may be aided by a fault having a down-throw to the north-east.

The

The nearly parallel valleys of Caledonia Creek (Glen Mowbray) and the Hodgkinson River are bounded on the right or north-eastern side by the Mount McGann Range, and on the opposite side by the Mount Robert Range. These ranges have had their trend determined indirectly by the forces which compressed the strata of the district from south-west to north-east and threw them into long folds from south-east to north-west. After the strata had been compressed into nearly as small a compass as they would go into—*i.e.*, till they became nearly vertical—the further operation of the same pressure resulted in the formation of fissures along lines of weakness; which lines of weakness were found in the bedding planes dividing the upturned strata from one another. These fissures, which are nearly, but not exactly, parallel with the outcrops of the strata, have been filled with a rock of great hardness, which, by its power of resisting denudation, has given rise to the Mount McGann and Mount Robert Ranges. Both of these ranges occur in zones in which the hard rocks in question are closely grouped together, while the intervening softer "country" has been channelled by the Hodgkinson River and Caledonia Creek into deep valleys.

The material with which the fissures are filled forms veins or dykes, from 3 to 40 feet in width, of pure silica in almost all of its various forms. It frequently resembles quartzite, and occasionally passes into ribbon jasper and calcedony. The veins are often so laminated parallel to their sides as to suggest that they may be beds rather than veins; but the mode in which they now and then cut across the adjacent strata, although preserving a general parallelism, sufficiently disproves this theory. Crystallisation is comparatively rare, and the lamination seems to imply by no means segregation of the silica from the surrounding strata, but rather deposition of silica during the passage of copious sheets of hot water charged with the mineral in solution. The veins (which they hardly are in the usual sense of the word) as laid down (in blue) on the map, are very striking, but in nature they are more remarkable still. They can be followed from hilltop to hilltop, forming at times rough insurmountable walls a hundred feet high, as for example in the peaks west of Mount Tenison-Woods. In other places denudation has left their remains on hill sides or hilltops in the form of huge cubes of hard quartzite, from which the surrounding softer rocks have crumbled away. These cubes stand up weird and solitary, like the "perched blocks" of alpine and arctic lands.

The linear persistence of the veins in question is very remarkable. One, for instance, has been traced (with a few breaks) from Mount McGann to the head of Tyrconnel Creek, a distance of over six miles. The two veins intersecting Mount Robert have been followed for four miles each. In these and many other cases the tracing of the veins was abandoned for no other reason than that the limit of the map had been reached. Similar veins, it may be here observed, have been noted by me in the Cloncurry and Leichhardt region, where they attain still more gigantic proportions. The veins of the Cloncurry and Hodgkinson resemble the dolerite dykes of Scotland and Ireland more than the ore-charged reefs of Australia. The Hodgkinson veins, I have been informed, contain rare and minute quantities of gold. I have not been able to verify this information, and I suspect that the gold may have come from reefs adjacent to the veins. Specular iron ore, brown hæmatite, and binoxide of manganese, are not uncommonly found in cavities of the larger veins, but I have never seen either in payable quantities.

Regarding the age of the stratified rocks of the Hodgkinson Goldfield, it may be as well, before reviewing the evidence, to shake ourselves free of all pre-conceived ideas on the subject. On the "authority" of various geologists the auriferous rocks of Northern Queensland have had attributed to them ages varying from Lower Silurian to Devonian. It is not, however, a question of authority, and the proofs of the age of New South Wales or Gympie rocks have no bearing on the age of rocks separated by 10 or 12 degrees of latitude, and whose connection with them has never been traced.

In a conglomerate on the hillside opposite the Glen Mowbray machine occur some large oval pebbles, or shingles of black shale. The shingles strongly resemble the graptolite shales of Victoria and the uplands of the south of Scotland. But they also are quite indistinguishable from the beds of dark shale which lie beside, and geologically both above and below the conglomerate bed in which they occur. I split open a great number of the shaley shingles in search of graptolites, but without success. They yielded, instead, a number of reed-like plant impressions, invariably too indistinct for determination.

Near the northern boundary of the township of Thornborough a miner named Murphy is tunnelling to cut the "Chance" reef. This locality is about a mile south of the conglomerate in Glen Mowbray, and the strata cut in the tunnel occupy a horizon which may be estimated at 4,620 feet below that of the conglomerate. They consist for the most part of dark-blue shales (commonly but improperly known as slates), with alternations of hard gritty greywackes and a few bands of fine conglomerate. The fine-grained greywackes yielded a "petrified snake," which was sent to the Brisbane Museum and pronounced by Mr. C. De Vis to be a *Lepidodendron*, probably *L. australe* of McCoy. I visited the spot afterwards, and saw some flattened stems and twigs which may have belonged to *Lepidodendron*, but from which all the characteristic markings had disappeared. My visit left no doubt in my mind regarding the *bona fides* of the discovery. I found among the shales numerous casts of crustacean or molluscan tracks, some reed-like plant-impressions, and a fragment of carbonised wood.

Even if the shale pebbles (or boulders or shingles, as the case may be) of the Glen Mowbray or other similar conglomerate should in future yield recognisable fossils, I should not necessarily regard the fossils as "derived" from some older formation which had been upheaved and subjected to denudation during the period marked by the deposition of the conglomerate. On the contrary, I should believe the fossils to be of practically contemporaneous origin. I believe the plant-remains of the Glen Mowbray shingles must have been derived from a shale bed which formed a part of the same formation. In my field experience nothing is more certain than that fragments of a shale bed will be found in any succeeding bed of conglomerate. The explanation is, I believe, to be found in the sun-drying and pealing off of flakes of the shale, and their subsequent partial rounding by attrition. I say this by way of caution against hasty conclusions from future discoveries. In the very probable event, for instance, of the discovery in shale shingles of a determinable fossil—say *Lepidodendron australe*—the conclusion would be that the conglomerate containing the shingle was deposited in a geological age subsequent to the deposition of the shale containing *Lepidodendron australe*. This conclusion would be erroneous.

At the intersection of the road from Thornborough to Glen Mowbray with that which leads up to the Pioneer and Tichbourne mines is the outcrop of a bed of conglomerate, in which pebbles up to 6 or 8 inches in diameter are packed in a matrix of greywacke. Of these some are greywacke, the majority

quartz

quartz, and a fair proportion blue coralline limestone. Similar limestone pebbles are found in conglomerates in a number of places—*e.g.*, on the hill west of the City of Dublin Reef, on the roadside in Glen Mowbray, near the junction of the Thornborough and Kingsborough roads, in the gully west of the shambles in Glen Mowbray, and in Tyrconnel Creek north of the Honest Lawyer.

As in the case of the shale pebbles of the Glen Mowbray conglomerate, I considered it very doubtful whether the fossils in the limestone pebbles were really "derived" from an older formation.* In this view I was subsequently confirmed by the discovery, about a mile and a-half south-west of Beaconsfield, of a conglomerate, with similar pebbles, containing similar fossils, almost immediately adjoining a limestone bed, which had been quarried for mortar for the antimony smelting-works at Northcote. This bed is vertical, 4 feet at least in thickness, and strikes north-north-west, as do all the strata in the neighbourhood. The limestone was found to contain a number of shells and corals; but among these I could only recognise a *Retzia* and *Cyathophyllum helianthoides* (Goldfuss).

The coral, which weather out in relief from the limestone pebbles of the conglomerates, may therefore be ranked as contemporaneous with the strata of the goldfield. They include, I believe, many genera common to the Yass beds in New South Wales, the Reid limestone near Townsville, and the Burdekin limestone near Dalrymple (Upper Silurian or Lower Devonian). *Retzia radialis* (Phillips) occurs in the Star beds, Upper Devonian or Lower Carboniferous. Another species (*R. salteri*) is met with in the Yarralumla (Yass) beds, New South Wales. *Cyathophyllum helianthoides* has been recognised in the Yass beds.

The Star beds are characterised by the occurrence of *Lepidodendron australe* (McCoy), which has never been traced upward into the productive portion of the coal measures. It will thus be seen that, according to the palæontological evidence, the homotaxis of the Hodgkinson rocks may be anywhere from Upper Silurian to Lower Carboniferous. The Lower Carboniferous appears to have the strongest claim, according to the plant-remains, while the corals seem to favour more the Lower Devonian. The Hodgkinson strata, on the other hand, have suffered greater metamorphism and disturbance than the Star beds, and less than the Burdekin and Reid beds.

The state of our knowledge of the series from the Reid limestone up to the top of the Bowen River coalfield will be best seen from *Diagram No.* 1.

It will be seen that gaps occur both at the base and at the top of the Star beds. The Hodgkinson beds, I believe, form part of the missing strata between the Star and the underlying Reid beds.

The auriferous reefs are divisible into two groups or orders. Those of the first group coincide in their strike with the strike of the strata in which they occur. To this group belong the Tasmanian, North Star, Outward Bound. Amy Moore, Vulcan, Britannia, Caledonia, Forget-me-Not, Von Moltke, Lady Mary, Mark Twain, Emperor, Rob Roy, Garry Owen, Tyrconnel, Black Prince, Henry Grattan, Commodore, Lizzie Redmond, Hero, Pioneer, Hope, and others. In all the members of this group a general law may be observed. They underlie at right angles to the dip of the strata. This circumstance can only mean that the fissures were produced by the same pressure that upturned the strata. Each stratum would break along a plane of least resistance, which would be found at right angles to the planes of bedding.

The second group, which comprises the Bismarck, King Attila, Lady Ann, Providence, Flying Pig, Tichborne, Idaho, Explorer, Great Northern, Devon and Cornwall, Empress of India, Alliance, Mowbray, Honest Lawyer, Fourth of July, Columbia and Eureka, runs mainly north and south, and at right angles to the lines which denote the outcrops of the stratified rocks. Their underlie is always to the east. It is probable that they belong to a period subsequent to the first series of fissures.

So far as the mines were accessible during the progress of the survey, I visited them. To make this report a complete summary of the condition of the field, I have also thrown into tabular form the returns of crushings in the Warden's office. I may mention that I detected many cases where the same crushing was obviously given in the returns of two succeeding months. The elimination of errors thus arising would cause a difference between my figures and the totals returned in the various years.

CENTRAL DISTRICT.

TASMANIAN.

Strike E. 39° S. Underlie S. 39° W

TASMANIAN CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.	Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.				tns. cwt.	oz. dwt. gr.	£ s. d.
Mar., 1877	P.C. ...	Welcome...	52 0	253 0 0		Mar., 1879	P.C. (surface)	Vulcan ...	48 0	25 0 0	
,, ,,	,, ...	,, ...	50 0	100 0 0		May, ,,	Buck Reef	,, ...	14 0	11 15 0	
June, ,,	No. 1 S.	Vulcan ...	150 0	174 0 0		July, ,,	P.C. ..	,, ...	54 0	58 0 0	
Aug., ,,	...	,,	84 0	239 0 0		April, 1880	,, ...	Pers'ver'nce	133 16	203 0 0	
Mar., 1878	P.C. ...	,, ...	133 0	272 2 0		May, ,,	,, ...	,, ...	55 0	14 14 0	
,, ,,	No. 1 S.	,, ...	127 0	227 0 0		Aug., ,,	No. 1 ...	,,	90 0	43 18 0	
April, ,,	No. 3 ...	,, ...	18 0	11 15 0		Sep., ,,	...	,, ...	not giv'n	77 9 0	
May, ,,	...	,, ...	122 0	196 0 0		Jan., 1881	P.C. ...	,, ...	74 0	61 15 0	
July, ,,	No. 1 S.	,, ...	152 0	196 0 0		April, ,,	No. 1 ...	,, ...	37 18	16 0 0	
Nov., ,,	No. 1 ...	,, ...	5 10	8 0 0		,, ,,	P.C. ...	,, ...	13 15	15 17 0	
,, ,,	P.C. ...	,, ...	53 0	61 0 0		Nov., 1882	No. 2 ...	,, ...	8 0	8 19 0	
Mar., 1879	No. 1 S.	,, ...	149 0	121 0 0		May, 1883	No. 1 E.	,, ...	48 0	17 10 0	
,, ,,	P.C. ...	,, ...	132 0	148 0 0							

* See Report of the Department of Mines for the year 1883, p. 55.

BLACK BALL.

This reef occurs near the head of Spring Creek. Its strike is south 10 degrees east, and its underlie at 65 degrees to west, 10 degrees south. Annexed is a sketch of the workings, on the scale of 64 feet to an inch. (*Diagram No. 2.*)

I visited this claim in December, 1883. At the depth of 40 feet in the engine shaft a large block of white quartz, 8 feet in thickness, came in. It was quite free of gold. At the south end of the 70-feet level (beyond the gully shaft) the quartz, after bulging to 18 inches (a great part of which is poor), dwindles to about 3 inches, but becomes richer in gold. On the same level to the north the stone has all been taken out and crushed, with a result of which Mr. Downie, the owner, estimates the crushings to have averaged 1 to 1½ ounces to the ton. The reef is not visible here. The hanging wall is mostly flakey black slaty gangue, while the footwall is greywacke.

The 135-feet level is carried 40 feet to the south, and 120 feet to the north. In the north end, after a blank, a reef comes in on the footwall. At the end it is nearly 2 feet wide. Part of it looks poor, but the last crushing of 193 tons, yielding 217 ounces of gold, came from this place; and Mr. Downie informed me that the whole of the stone, without selection, passed through the machine. This crushing cost six weeks' work of six men.

At the 205-feet level the reef is rather flatter than its general underlie. It is 2 to 3 feet in thickness at the end of the level. The quartz has its joints coated with carbonate of lime, which has a greenish tinge from the presence of a minute quantity of carbonate of copper. It shows gold freely, and is expected to give a good yield. From the end of the stope and back to the shaft the stone is very thick, but nearly two feet of it is without gold.

BLACK BALL CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.	Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.				tns. cwt.	oz. dwt. gr.	£ s. d.
Mar., 1877	P.C. ...	Welcome...	34 0	50 0 0		May, 1880	No. 1 ...	Pers'ver'nce	8 0	10 10 0	
May, ,,	No. 1 ...	Vulcan ...	44 0	42 0 0		June, ,,	P.C. ...	,, ...	53 0	86 2 0	
Aug., ,,	P.C. ...	,, ...	40 0	56 0 0		Aug., ,,	No. 1 ...	,, ...	49 0	69 18 0	
April, 1878	,, ...	,, ...	105 0	106 0 0		,, ,,	P.C. ...	,, ...	33 0	25 17 0	
Aug., ,,	No. 1 S.	,, ...	27 0	27 5 0		Nov., ,,	,, ...	,, ...	25 0	21 13 0	
,, ,,	P.C. ...	,, ...	50 0	76 0 0		Dec., ,,	No. 1 ...	,, ...	45 10	61 10 0	
Mar., 1879	,, ...	,, ...	52 0	82 0 0		April, 1881	...	,, ...	11 10	14 7 0	
June, ,,	,, ...	,, ...	12 0	12 15 0		Nov., 1882	P.C. ...	,, ...	91 0	189 0 0	
Aug., ,,	,, ...	,, ...	78 0	107 0 0		May, 1883	...	Vulcan ...	164 0	208 15 0	
Mar., 1880	No. 1 ...	Pers'ver'nce	26 5	34 5 0		Aug., ,,	Lease ...	Pers'ver'nce	193 0	217 0 0	
,, ,,	P.C. ...	,, ...	218 7	175 0 0							

HOMEWARD BOUND.

The Homeward Bound, North Star, Good Hope, Outward Bound, and Going-Home, are grouped closely together on the crown of a round hill on the north side of the main range dividing the Spring Creek Valley from Glen Mowbray. Seen from the range the Hill appears to be a mass of quartz.

The Homeward Bound reef strikes east 20 degrees north, and underlies to south 20 degrees east, in dark shale country. I visited the mine in 1880. When I was again in the district in December, 1883, it had just been abandoned, after having been held for about two years by a limited liability company.

In 1880 the principal shaft was one which followed the underlie of the reef to a depth of 210 feet. The greater part of the workings was on the west, or uphill side of the underlie shaft. For the first 25 feet the stone on the west of the shaft had been taken out. The 80-feet level had been carried 129 feet to west 20 degrees south from the shaft. The quartz was there upwards of six feet in thickness, but poor and white. The best stone occurred in the hanging-wall. At the end of the level the stone thinned out to about three feet, the greater part of this being white and poor. Some six inches of stone on the hanging wall were streaked with black stains, and tolerably rich in gold.

Forty feet above the lowest level a mass of streaky quartz appeared on the east side of the shaft. It was like a wedge with the thin edge upwards. In the shaft (on the east side) it was five feet thick at the bottom of the shaft. At the same place another reef went into the footwall to the west-north-west.

About fifteen feet west of the bottom of the shaft a wedge-like body of quartz made its appearance, and widened westward till about thirty-five feet from the shaft it was eight to ten feet wide. Ten feet further the reef had thinned to three feet, with eighteen inches of quartz between two bands of black "mullack" or gangue. From this point up to the shaft at the surface the shoot of stone had been continuously worked, and it had averaged 1½ ounces to the ton. The "shoot" "dipped" to the west at an angle of about one in four.

At the west end of the level the attached sketch (*Diagram No.* 3) was made to illustrate the relation of the "stone" (auriferous quartz) to the "mullack" (gangue). So far as I could follow up the face of the stope from the end of the lowest level, the reef seemed to average two feet in thickness, of which a fair proportion was auriferous quartz.

the 140 feet level a large block of stone was driven on to the east till the level ended in a six-inch reef. The large block yielded well.

As the table of crushings shows since 1880 a decrease in the yield of quartz in spite of the capital of the company, and in the gold-contents of the stone as well, it may be inferred that the large shoot of stone had well-nigh died out.

HOMEWARD

HOMEWARD BOUND CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
April, 1877	P.C. ...	Welcome...	112 0	108 17 0	
Aug., „	„ ...	Vulcan ...	20 0	41 0 0	
Feb., 1878	„ ...	„ ...	20 0	31 0 0	
Nov., „	„ ...	„ ...	67 0	160 0 0	
Feb., 1879	„ ...	„ ...	279 0	773 0 0	
May, „	„ ...	„ ...	216 0	346 0 0	
Sep., „	„ ...	„ ...	420 0	747 0 0	
„ „	No. 1 ...	„ ...	33 0	30 0 0	
Oct., „	„ ...	„ ...	16 0	16 0 0	
„ „	P.C. ...	„ ...	200 0	386 0 0	
Feb., 1880	„ ...	Pers'ver'nce	491 12	673 10 0	
Mar., „	No. 1 ...	„ ...	65 3	84 10 0	
April, „	P.C. ...	„ ...	439 10 3 lbs.	854 0 0	
„ „	„ ...	„ ...	94 0	73 10 0	
June, „	No. 1 ...	„ ...	21 16	...	
„ „	P.C. ...	„ ...	307 0	238 0 0	
Sep., „	...	Vulcan ...	409 0	352 0 0	
Oct., „	...	„ ...	51 0	80 0 0	

HOMEWARD BOUND CRUSHINGS—*continued.*

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
Nov., 1880	P.C. ...	Pers'ver'nce	314 0	230 10 0	
Jan., 1881	„ ...	„ ...	303 0	234 18 0	
Mar., „	United...	„ ...	306 19	176 6 0	
May, „	...	„ ...	165 0	111 9 0	
June, „	...	„ ...	136 0	115 5 0	
Aug., „	...	„ ...	174 0	155 9 0	
Sep., „	...	„ ...	100 0	64 4 0	
May, 1882	P.C. ...	„ ...	33 0	39 0 0	
„ „	Lease ...	„ ...	180 0	96 0 0	
Sep., „	...	„ ...	240 0	324 0 0	
May, 1883	Lease ...	„ ...	247 0	93 0 0	
Aug., „	...	„ ...	80 0	40 0 0	

GOING-HOME CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
May, 1880	P.C. ...	Pers'ver'nce	29 10	12 10 0	
Sep., 1882	...	„ ...	57 0	43 10 0	
May, 1883	P.C. ...	„ ...	38 15	37 15 0	

GOOD HOPE.

This reef, as well as the Homeward Bound, cuts across the bedding of the rocks. It strikes east 10 degrees north, and underlies south 10 degrees east. It has a large "blow" on the road on the hilltop. It has been opened a little on the eastern side of the hill, but a crushing of 50 tons only yielded 8 dwts. of gold per ton. This crushing is given on the authority of Mr. William Stenhouse, late owner of the machine, but it is not included in the official returns, the stone having perhaps been included in the crushings from some other mine.

OUTWARD BOUND.

This reef occurs on the fall of the hill to the west of the Homeward Bound and Good Hope. A tunnel 25 feet long has been driven to north 30 degrees east. The reef being cut here is sunk upon for 95 feet to the south-west. Its stike is north 33 degrees west.

At the north-west end of the bottom level the reef is about 4 feet thick, with distinct walls—indeed, the walls are very regular throughout, but gangue is more plentiful than quartz. In the upper levels wedges of quartz come in. At the lowest face the quartz forms nearly the whole thickness of the reef, but flakes of poor and rich stone alternate.

OUTWARD BOUND CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns cwt.	oz. dwt. gr.	£ s. d.
Mar., 1878	P.C. ..	Vulcan ...	66 0	66 10 0	
May, „		„ ...	6 0	7 0 0	
June, 1879	P.C. ...	„ ...	8 0	5 6 0	
Oct., „	„ ...	„ ...	32 0	22 0 0	
Mar., 1880	„ ...	Pers'ver'nce	49 4	32 15 0	
May, 1880	...	Pers'ver'nce	14 0	10 10 0	
Aug., „	...	„ ...	30 0	9 7 12	
Sep., „	...	„ ...	44 0	23 10 0	
Nov., „	P.C. ...	„ ...	21 0	14 5 0	

NORTH STAR, P.C.

This reef strikes north-west and underlies south-west. It is cut at 58 feet by a vertical shaft, which then follows the underlie. Where the reef was struck by the shaft there was nothing but gangue, but a little down the underlie it consisted of one foot of gangue on the hanging wall, one foot of good striped stone, and 2 feet of poor white stone on the footwall.

At the lowest level, 30 feet south-east of the shaft, the reef narrows to 18 inches of dull white quartz with spots of galena, the uppermost 5 inches being streaky and rubbly and richer in gold than the rest. About 10 feet from the shaft, 6 inches of very good stone were seen on the hanging-wall. Below this were 18 inches of poorer stone, and 1 foot of gangue. The whole 24 inches of stone were crushed together and yielded 1 oz. 12 dwts. of gold per ton.

NORTH STAR CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
Mar., 1877	P.C. ...	Welcome...	95 10	130 0 0	
June, „	...	Vulcan ...	22 0	23 0 0	
Aug., „	No. 2 ...	„ ...	80 0	46 0 0	
Mar., 1878	P.C. ...	„ ...	52 0	107 0 0	
June, „	...	„ ...	35 0	41 0 0	
Nov., „	...	„ ...	10 0	11 0 0	
Dec., „	No. 1 W.	„ ...	19 0	21 0 0	
May, 1879	P.C. ...	„ ...	22 0	34 0 0	
July, „	...	„ ...	23 0	19 0 0	
Sep., „	...	„ ...	34 0	34 0 0	
Dec., „	...	„ ...	22 0	24 11 0	
May, 1880	P.C. ...	Pers'ver'nce	20 0	28 0 0	
June, „	No. 1 ...	„ ...	73 0	39 16 0	
Aug., 1880	No. 2 ...	Pers'ver'nce	34 0	16 5 0	
Sep., „	...	Vulcan ...	126 0	200 0 0	
Dec., „	...	„ ...	150 0	126 0 0	
Jan., 1881	No. 1 ...	Pers'ver'nce	36 0	37 15 0	
April, „	No. 1 ...	„ ...	73 13	66 14 0	
June, „	...	Vulcan ...	60 0	22 5 0	
„ „	No. 1 ...	Pers'ver'nce	43 0	34 1 0	
July, „	...	„ ...	43 0	31 7 0	
Sep., „	...	„ ...	94 0	60 8 0	
Oct., „	...	„ ...	20 0	31 2 0	
May, 1883	Lease ...	„ ...	128 0	61 0 0	
Aug., „	...	„ ...	92 0	25 0 0	

AMY MOORE.

This reef occurs high up on the range to the north-west of the Homeward Bound. Its strike is east 30 degrees south, and its underlie south 30 degrees west. The reef appears to have only afforded one crushing of 30½ tons (at the Perseverance machine), yielding 24 ounces of gold, in December, 1880.

VULCAN CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
May, 1877	No. 1 ...	Vulcan ...	35 0	65 0 0	
„ 1878	No. 2 ...	„ ...	96 0	152 0 0	
June	P.C. ...	„ ...	40 0	24 3 0	
Mar. 1879	No. 1 W.	„ ...	130 0	320 0 0	
„ „	No. 3 W.	„ ...	1 4	17 6 5	
May, „	Surface	„ ...	24 0	8 0 0	
„ „	No. 3 ...	„ ...	6 0	5 2 0	
June, „	No. 2 ...	„ ...	174 0	341 0 0	
Aug., „	No. 1 ...	„ ...	32 0	38 0 0	
June, 1880	Extended	„ ..	100 0	47 6 0	
July, „	...	„ ..	20 0	12 9 0	
Sep., „	No. 2 W.	„ ..	318 0	344 0 0	
Oct., „	P.C. ...	„ ...	18 0	5 0 0	
„ „	No. 1 W.	„ ...	72 0	70 0 0	
July, 1881	No. 1 ...	„ ...	35 0	22 10 0	
„ „	P.C. ...	„ ...	150 0	138 7 0	
May, 1882	No. 2 ...	„ ...	142 0	174 5 0	
June, „	...	„ ...	19 6	15 15 0	
Mar., 1883	...	„ ...	4 17	1 9 0	

BRITANNIA CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
Mar., 1877	P.C. ...	Welcome (Kingsboro')	12 10	28 0 0	
April, „	No. 1 E.	„ ...	47 0	72 3 12	
May, „	No. 1 ...	Vulcan ...	34 0	10 10 0	
Feb., 1878	„ ...	„ ...	44 0	147 0 0	
April, „	No. 1 W.	„ ...	26 0	26 10 0	
May, „	P.C. ...	„ ...	35 0	52 0 0	
„ „	No. 1 ...	„ ...	22 0	62 0 0	
Aug., „	P.C. ...	„ ...	86 0	109 9 0	
Jan., 1879	No. 1 W.	„ ...	79 0	55 0 0	
„ „	P.C. ...	„ ...	68 0	36 0 0	
Feb., „	No. 1 W.	„ ...	13 0	10 14 0	
Mar., „	No. 1 W,	„ ...	36 0	24 7 0	
May, „	No. 1 ...	„ ...	36 0	18 0 0	
„ „	P.C. ...	„ ...	46 0	18 0 0	

BRITANNIA CRUSHINGS—*continued.*

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
Aug., 1879	No. 1 ...	Vulcan ...	110 0	100 0 0	
Dec., „	...	„ ...	77 0	28 0 0	
Feb., 1880	...	„ ...	8 0	3 15 0	
Sep., 1881	...	„ ...	35 0	17 7 0	
Oct., 1882	...	Pers'ver'nce	53 0	66 1 0	

CALEDONIA CRUSHINGS

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
Feb., 1877	P.C. ...	Welcome...	95 0	210 0 0	3 9 6
„ „	No. 1 W.	„ ...	53 0	91 0 0	3 10 8
„ „	No. 1 E.	„ ...	56 0	123 0 0	3 13 5
April, „	No. 2 W.	„ ...	22 0	39 6 0	
June, „	No. 1 W.	Vulcan ...	114 0	232 0 0	
July, „	No. 2 ...	„ ...	53 0	47 0 0	
Aug., „	No. 1 E.	„ ...	114 0	204 0 0	
„ „	P.C. ...	„ ..	132 0	164 0 0	
Feb., 1878	„ ...	„ ..	73 0	124 0 0	
May, „	„ ...	„	72 0	183 0 0	
Nov., „	Surface	„ ...	6 10	3 0 0	
Dec., „	No. 1 W.	„ ...	99 0	259 10 0	
Jan., 1879	P.C. (seconds)	„ ...	16 0	6 13 0	
„ „	P.C. ...	„ ...	46 0	55 16 0	
May, „	„ ...	„ ...	174 0	133 2 0	
July, „	„ ...	„ ...	138 0	202 0 0	
Aug., „	„ ...	„ ...	108 0	130 0 0	
Oct., „	„ ...	„ ...	179 0	146 0 0	
Feb., 1880	„ ...	„ ...	82 0	66 9 0	
June, „	„ ...	„ ...	178 0	96 16 0	
Oct., „	„ ...	„ ...	158 0	205 0 0	
„ „	No. 3 ...	„ ...	14 0	14 10 0	
Jan., 1881	P.C. ...	„ ...	42 0	80 0 0	
„ „	Surface	„ ...	34 0	24 10 0	
May, „	...	„ ...	103 0	130 15 0	
Jan., 1882	...	„ ...	30 0	10 4 0	
April, „	...	„ ...	80 0	40 10 0	
Jan., 1883		„ ...	18 18	12 16 0	
„ „	...	„ ...	10 7	9 14 0	

MARK TWAIN.

This reef, when I visited it in 1880, was worked by a shaft 47 feet vertical, and on the underlie (to the south at 57 degrees) 99 feet. Its course varies from east 6 degrees north to east 35 degrees north.

At the bottom of the vertical shaft, a level was driven to the east. The reef was, however, thin and poor (1 foot to 8 inches) till the level had been carried 85 feet from the shaft. Then the gold began to come in, and the shoot of auriferous quartz was worked up to the surface, and the level was carried on to a distance of 135 feet from the shaft. The stone has been taken out up to the surface from the end of this level to 85 feet from the shaft. At 120 feet from the shaft a pass connects this with the bottom level.

Down the underlie shaft (99 feet) from the upper to the bottom level, the reef averages nine inches thick, sometimes occurring in two layers and occasionally in three. Half way down the underlie it thins out to two or three flags of half-an-inch in thickness. At the bottom it is about a foot thick.

At the bottom another level is driven for 150 feet to the east, or to be precise, 66 feet to east 6 degrees north, 34 feet 2 inches to east 4½ degrees north, and 50 feet to east 35 degrees north. The reef was from 1 foot to three inches thick, but was of no value for the first 128 feet. Here, after the reef had almost thinned out, it rapidly bulged to about 20 inches on the footwall. The quartz is divided by dark streaks (parallel with the walls). Where the reef begins to be rich a leader of quartz carrying no gold, but perhaps influencing the productiveness of the reef itself, goes into the hanging-wall and underlies to the west. It is composed of two flags (three inches and four inches respectively) of quartz with dark streaks which contain minute specks of grey antimony ore. From this point to the end of the level the stone was good. It was about 1 foot thick at the face. A sketch of the workings on the scale of 128 feet to an inch is appended hereto. (*Diagram No.* 4.)

It will be obvious that the engine shaft is very unfortunately situated for the economical working of the rich shoot of stone. Accordingly a vertical shaft has been begun uphill to the east, which is expected to strike the reef at the depth of 215 feet below, and to the east of the present bottom level. The table of crushings will show how much may be expected from the economical working of the large body of stone which almost certainly remains to be worked above the lower level, without reckoning what may be found below.

MARK

MARK TWAIN CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt gr.	£ s. d.
Dec., 1876	P.C. ...	X.L. ...	111 10	389 10 0	3 14 10
Jan., 1877	No. 1 E.	,, ...	21 0	9 5 0	3 7 0
April, ,,	P.C. ...	,, ...	106 0	292 0 0	
June, ,,	,, ...	,, ...	122 0	376 0 0	
Feb., 1878	,, ...	,, ...	402 10	554 10 0	
April, ,,	No. 1 W.	,, ...	42 0	123 12 0	
July, ,,	P.C. ...	Goldfinder	177 0	165 0 0	
,, ,,	No. 1 W.	,, ...	55 10	103 15 0	
,, ,,	No. 1 W. (buck stone)	,, ...	37 0	17 4 0	
Aug., ,,	P.C. ...	,, ...	98 0	248 0 0	
,, ,,	P.C. (seconds)	,, ...	51 10	21 0 0	
Jan., 1879	No. 1 W.	,, ..	37 10	42 4 0	
,, ,,	P.C. ...	,, ...	176 10	151 5 0	
Feb., 1879	No. 1 W.	Goldfinder	5 0	3 5 0	
May, ,,	No. 1 ...	,, ...	8 0	12 7 0	
June, ,,	P.C. ...	,, ...	11 0	29 0 0	
,, ,,	No. 1 S.	,, ...	12 0	17 5 0	
July, ,,	P.C. ...	,, ...	71 0	29 5 0	
,, ,,	No. 1 E.	,, ...	7 0	2 4 0	
Sep., ,,	P.C. ...	,, ..	58 0	80 5 0	
,, ,,	No. 1 ...	,, ..	19 0	16 0 0	
Feb., 1880	,, ...	Glen Mowbray	82 10	74 0 0	
Mar., ,,	P.C. ...	,, ...	36 0	86 0 0	
Dec., ,,	..	,, ...	48 0	18 0 0	
Jan., 1881	No. 1 ..	,, ..	21 0	19 0 0	
April, ,,	...	,, ..	328 0	468 0 0	
Aug., ,,	...	,, .	93 0	95 9 0	

LADY MARY.

The workings were not accessible during my visits to the district. Mr. Finnegan, of the Lady Catherine mine, informed me that the shoot of auriferous stone extended over the whole length of the prospecting claim and part of No. 1 East. It underlay a good deal to the east. The quartz did not run out, but the gold died out of it.

LADY MARY CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
Dec., 1876	P.C. ...	X.L. ...	50 0	323 0 0	3 3 0
Mar., 1877	No. 1 ...	,, ...	45 0	115 0 0	
May, ,,	P.C. ...	,, ...	73 15	380 0 0	
,, ,,	No 1 S.	,, ...	70 10	180 0 0	
Feb., 1878	No. 1 ...	,, ...	128 15	266 10 0	
Mar., ,,	No. 1 S.	,, ...	128 0	256 0 0	
June, ,,	P.C. ...	Goldfinder	254 0	406 10 0	
,, ,,	No. 1 ...	,, ...	52 0	72 10 0	
June, 1878	No. 1 N.	X.L. ...	15 0	12 18 0	
July, ,,	P.C. (surface)	Goldfinder	40 0	19 13 0	
June, 1879	P.C. ...	,, ...	192 0	429 0 0	
Sep., ,,	Lease ...	,, ...	38 0	16 0 0	
Feb., 1880	...	Glen Mowbray	23 0	13 0 0	

LADY CATHERINE.

The Lady Catherine reef is nearly in the same line as the Lady Mary and Mark Twain. It underlies to the South.

The first holders sunk the present main shaft to the depth of 60 feet, and stoped out the stone for about 40 feet to the west and 30 feet to the east. They took out 179 tons of quartz which yielded 256 ounces of gold—1 oz. 9 dwts. per ton.

The present owners (Messrs. Finnegan Brothers) have held the mine for four years. As the stone on the west of the shaft (about 15 inches thick) appeared to be poor, they shifted the skids a little to the east. They have sunk the shaft to a total depth of 230 feet, taking out the quartz on the east side for a distance of 30 feet from the shaft all the way down. They have crushed hitherto 405 tons for 672 oz.—1 oz. 13 dwts. per ton.

From 65 feet down to 80 feet on the west side of the shaft coarse gold was left unworked. (Here there is a copious exudation of sulphate of magnesia from the walls of the reef.) At 80 feet on the same side a two-feet reef of barren milk-white quartz cut out the auriferous quartz, but itself thinned out to the east. A few feet lower (on the west side of the shaft) a good veined reef comes in on the top of the barren stone and opens out downward.

At about 180 feet a break of 7 feet wide occurs in the reef. Here the bedding of the country rock is seen. It consists of gnarled black shale striking west-north-west, and dipping a little to north-north-east. From above the break a crushing of 54 tons was taken out, which gave 107 oz. 8 dwts. of gold.

From this break upwards the underlie is only 35 degrees. Below the break it is 45 degrees.

A level has been driven 70 feet east from the bottom of the shaft. A shoot of stone is blocked out from the end of this level till it is cut, 40 feet above the bottom level, at 40 feet from the shaft, by a level which is carried 80 feet east of the shaft. The present workings are at the latter level. All below is under water. The water, however, is trifling. Baling 300 gallons per day suffices to keep it under From the end of this level (40 feet from the bottom) the stone is stoped out for 20 feet up. Hence came a recent crushing of 79 tons, which yielded 86 ounces of gold (not given in the returns), and about 35 tons lying at the surface in October 1883. Part of this heap has visible gold along and adjacent to the black seams.

From the same level I followed the workings for 50 feet up by a pass starting from 40 feet east of the main shaft. The stone has all been taken out for 25 feet to the west of the pass and eastward to the stope at the end of the level. At the top of the 50 feet pass, the stone is seen to be from 8 inches to 20 inches wide. Where it is at its thickest it is compact and milk-white, but it is said to carry gold on top and bottom. Where it is thinner it is full of black seams and has a fair quantity of gold "peppered" along and adjacent to the seams. The seams referred to are blackened by thin films of dark slate-clay and fibrous serpentine.

The

The footwall is generally pretty distinct, but the hanging-wall is not, as the greywacke and shale beds have not been neatly fissured, but "haggled" unequally, according to their varying hardness.

LADY CATHERINE CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.	Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.				tns. cwt.	oz. dwt. gr.	£ s. d.
Mar., 1878	P.C. ...	X.L. ...	49 0	81 2 0		Jan., 1881	P.C. ...	Mowbray	119 0	266 0 0	
July, ,,	,, ...	,, ...	57 0	116 0 0		May, ,,	...	,, ...	54 0	107 8 0	
Feb., 1879	,, ...	Goldfinder	59 10	43 0 0		May, 1882	P.C. ...	,, ...	129 0	135 0 0	
April, ,,	,, ...	,, ...	14 0	16 0 0		Jan., 1883	...	,, ...	62 0	72 0 0	
Feb., 1880	...	,, ...	21 0	72 0 0		May, ,,	...	,, ...	17 0	20 0 0	

CARDIGAN.

A tunnel has been driven to cut the reef and a shaft has been sunk 70 feet down from the tunnel on a shoot of stone, and up to the surface. The shoot, according to Mr. Finnegan, dipped a little to the east.

CARDIGAN CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.	Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.				tns. cwt.	oz. dwt gr.	£ s. d.
Jan., 1877	No. 1 ...	X.L., Glen-Mowbray	41 17	32 0 0	2 11 5	May, 1879	P.C. ...	Goldfinder	308 15	241 10 0	
						July, ,,	,, ...	,, ...	88 0	56 0 0	
Feb., ,,	P.C. ...	,, ...	101 0	475 0 0		,, ,,	,, ...	,, ...	61 0	15 0 0	
Aug., 1878	...	Goldfinder	13 10	7 0 0		Sep., ,,	,, ...	,, ...	75 0	109 0 0	
Mar., 1879	P.C. ...	,, ...	610 0	623 0 0		Mar., 1880	,, ...	Glen Mowbray	156 0	75 0 0	

VON MOLTKE.

This reef underlies to the south at 60 degrees. It has been worked by a tunnel driven from the gully on the west, for about sixty feet along the reef, and up to the surface from the level of the tunnel. Beside the mouth of the tunnel is a shaft, twenty-five feet vertical and thirteen or fourteen feet on the underlie. This was on a good shoot. All the quartz excavated was crushed. The reef has been worked opencast for about 180 feet continuously, and in small openings it may be traced for about an equal distance to the crown of the ridge.

VON MOLTKE CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.	Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.				tns. cwt.	oz. dwt. gr.	£ s. d.
Mar., 1877	P.C. ...	X.L. ...	37 0	34 5 0		Feb., 1879	P.C. ...	Goldfinder	81 0	81 0 0	
June, ,,	Surface	,, ...	90 0	58 16 0		Sep., ,,	...	,, ...	10 10	2 0 0	
April, 1878	...	,, ...	28 10	44 4 0		Jan., 1880	...	Mowbray	14 0	39 0 0	
June, ,,	P.C. ...	,, ...	13 0	15 6 0		Aug., ,,	...	,, ...	9 10	9 15 0	
Aug., ,,	,, ...	Goldfinder	47 10	69 0 0							

BISMARCK.

This reef runs nearly east and west, and underlies at 45 degrees to the north.

The present working (November, 1883) is only twenty-eight feet deep. The quartz is one to ten inches wide. At 24 feet the reef intersects a dividing line between two beds of sandstone, one soft and the other hard, and gold begins to appear, some fine specimens having been obtained lately. This is the eastmost working on the line of reef. About 70 feet west of the shaft a bar of vertical shale occurs, striking north-west and south-east. This is supposed to cut out the reef. At all events the latter is not traceable at the surface for about 30 feet.

Two hundred feet west of the present shaft (Robinson's) a shaft has been sunk by former holders, and has caught the reef at twelve feet. Thirty feet to the dip another shaft has been sunk, striking the reef at fifty-five feet. The ground between the two shafts has been worked out. The shoot of gold here is said to have been nine feet wide when it was at its best, but it was worked in places to a much greater width. The shaft last referred to was sunk sixty-feet on the underlie, but it is filled in with "mullack" below the level of the vertical shaft. At the bottom of the vertical shaft the quartz is visible on the east side from 0 to 2 inches thick, but there is sometimes only a thin band of iron-stained gangue. The quartz was no doubt wider on the other side, but from the crushings returns it will be seen that the total annual out-put of stone was always small. The reef is a very thin one. The true "formation" or gangue is only a few inches thick, but it has pleased the miners to regard a joint in the greywacke "country," about four feet above the reef, as a "hanging-wall."

The workings last described are the westmost on the Bismark reef. A cross reef comes in to the west, but the junction of the two has not been observed, as the Bismark appears to have thinned out before reaching the point of intersection   The

The cross reef referred to strikes west-north-west, and underlies to the west-south-west. It has been worked a little on the surface. Where the reef is left the quartz is 1 to 4 inches wide. It is said to have given 2 to 3 ounces of gold to the ton. A good patch was obtained on it on the north side of the gully. The crushings are probably included in the returns of the Bismarck.

BISMARCK CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
Jan., 1877	P.C. ...	X.L., Glen Mowbray	9 0	40 0 0	3 9 0
Mar., ,,	,, ...	,, ...	12 0	32 5 0	
,, ,,	,, (surface)	,, ...	26 0	12 9 0	
Aug., 1878	,, ...	Goldfinder, Gl. M.	5 0	13 5 0	
Jan., 1879	,, (surface)	,, ...	14 10	6 10 0	
,, ,,	,, ...	,, ...	24 0	92 0 0	
June, 1879	P.C. ...	Goldfinder, Gl. M.	25 0	19 5 0	
Sep., ,,	,, ...	,, ...	11 0	39 0 0	
Feb., 1880	,, ...	Glen Mowbray	12 0	66 0 0	
April, 1881	...	,, ...	31 0	63 0 0	
Aug., ,,	...	,, ...	9 0	27 17 0	
Sep., ,,	...	,, ...	9 0	29 0 0	
April, 1882	P.C. ...	,, ...	7 0	10 0 0	
Jan., 1883	,, ...	,, ...	6 0	21 0 0	

EMPEROR.

This reef runs north-north-west, and underlies the west-south-west. It is seen on the surface abutting against the Bismarck, west of the shale bar, between Robinson's shaft and the deep shaft.

EMPEROR CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
Jan., 1877	P.C. ...	X.L. ...	15 0	43 15 0	3 9 0
Feb., ,,	No. 1 N.	Hercules ...	11 0	48 2 0	3 7 6
Mar., ,,	P.C. ...	X.L. ...	13 0	31 15 0	
June, ,,	,, ...	,, ...	9 0	10 5 0	
April, 1878	...	,, ...	16 10	39 8 0	
June, ,,	...	,, ...	19 0	22 11 0	
Jan., 1879	P.C. ...	Goldfinder	5 0	20 0 0	
April, ,,	,, ...	,, ...	13 10	41 0 0	
July, ,,	,, ...	,, ...	27 0	58 10 0	
Sep., ,,	,, ...	,, ...	10 0	8 0 0	
Jan., 1880	...	Glen Mowbray	18 10	19 0 0	

Another reef parallel with the Emperor passes the east end of the Bismarck. The quartz is 4 inches wide. It is said to have crushed at the rate of 4 ounces to the ton, but it did not go down.

KING ATTILA.

This reef lies to the east of the Emperor. It runs north and south, and underlies to the west. It was worked in an underlie shaft to the depth of 30 feet. At the mouth of the underlie shaft there are quartz veins aggregating from 4 to 10 inches. Only one crushing is recorded. It took place in December, 1876, at the X.L. machine. Twenty-seven tons of stone yielded 37 ounces of gold, valued at £3 7s. 5d. per ounce.

LADY ANN.

This is a vertical reef running north-north-east, on the hillside, behind the Glen Mowbray machine. It has been worked mainly opencast. It seems to have yielded pretty steadily about an ounce to the ton; but the crushings, it will be seen, have never been large.

LADY ANN CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
Feb., 1877	...	X.L. (Spain's)	10 0	10 14 0	3 10 6
Mar., ,,	...	,, ...	9 0	7 16 0	
June, ,,	P.C. ...	,, ...	15 15	20 5 0	
Mar., 1878	No. 1 N.	,, ...	27 0	37 3 0	
,, ,,	P.C. ...	,, ...	35 0	52 3 0	
April, ,,	No. 1 ...	,, ...	9 0	4 19 2	
,, ,,	...	,, ...	16 10	27 14 0	
June, ,,	...	,, ...	25 10	26 4 0	
June, 1878	No. 1 N.	X.L. (Spain's)	5 0	1 10 0	
July, ,,	P.C. ...	,, ...	6 0	6 6 0	
Aug., ,,	,, ...	,, ...	5 0	3 0 0	
Feb., 1880	...	Glen Mowbray	10 10	6 10 0	
June, ,,	Extended	,, ...	25 0	27 2 0	
Sep., ,,	...	,, ...	15 0	14 15 0	
Dec., ,,	...	,, ...	15 0	15 0 0	

PROVIDENCE.

This reef occurs high on the hill to the east of Glen Mowbray machine. It strikes north-west and underlies at seventy-five degrees to the south-west. It has been worked opencast for about 100 yards, and in three-deep underlie shafts and one-deep vertical shaft.

PROVIDENCE CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.	Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.				tns. cwt.	oz. dwt. gr.	£ s. d.
April, 1878		X.L. ...	46 0	96 10 0		Feb., 1880	P.C.	Goldfinder	38 0	38 0 0	
June, ,,	P.C. ...	,, ..	10 10	6 10 0		Aug., ,,		Mowbray	20 0	17 7 0	
Feb., 1879	,, ...	Goldfinder	79 0	148 0 0		April, 1881		,, ...	15 0	15 0 0	
,, ,,	Extended	,, ..	37 10	25 15 0		,, 1882	P.C.	,,	22 0	30 0 0	
Aug., ,,	P.C. ...	,, ...	31 17	55 0 0							

CROSS' PROTECTION AREA.

Lies downhill, and westward from the Providence reef. A 20-feet shaft has een sunk on a leader of quartz two to four inches thick, which runs north-north-west and underlies to west-south-west at 40 degrees. The "country" is very hard greywacke. About 2 tons of stone are paddocked from this shaft, and an open underlie shaft above.

WATERFORD CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
April, 1878	...	X.L. ...	23 0	53 18 0	
June, ,,	...	,, ...	4 10	9 5 0	
July, ,,	...	,, ...	10 0	12 0 0	
,, ,,	No. 2 ...	,, ...	5 0	3 0 0	
Feb., 1879	P.C. ..	Goldfinder	10 0	15 0 0	
Aug., ,,	,, ...	,, ...	3 0	22 10 0	
Sep., ,,	,, ...	,, ...	9 10	9 0 0	
Mar., 1880	...	Mowbray	16 0	77 0 0	
Sep., ,,	...	,, ...	14 10	53 8 0	
Dec., ,,	...	,, ...	16 0	60 0 0	
April, 1881	...	,, ...	19 0	25 0 0	
July, ,,	...	,, ...	23 0	30 13 0	
April, 1882	P.C. ...	,, ...	31 0	50 0 0	
Mar., 1883	...	,, ...	21 0	49 0 0	

CITY OF DUBLIN CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
June, 1878	P.C. ...	X.L. ...	6 0	22 9 0	
July, ,,	,, ...	,, ..	29 0	14 1 12	
,, ,,	,, ...	,, ...	9 0	2 0 0	
April, 1879	,, ..	Hercules ...	3 0	4 5 0	
July, ,,	...	Goldfinder	28 0	20 10 0	

BLACK PRINCE CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
Feb., 1877	P.C. ...	Hercules ...	11 0	57 10 0	
Aug., ,,	,, ...	Hercules (Thornboro')	12 0	10 0 0	
Sep., ,,	No. 2 W.	,, ...	2 0	3 12 12	
Jan., 1878	P.C. ...	,, ...	61 15	213 0 0	
April, ,,	,, ...	,, ...	46 0	217 5 0	
,, ,,	No. 2 W.	,, ...	28 10	12 15 0	
July, ,,	No. 2 ...	X.L., Glen-Mowbray	10 0	9 13 0	
Aug., ,,	P.C. ...	Goldfinder, Glen Mow-bray	40 10	139 5 0	
Feb., 1879	,, ...	Hercules ...	54 5	167 13 0	
June, ,,	,, ...	,, ...	42 0	84 0 0	
,, ,,	,, ...	,, ...	2 10	11 0 0	
,, ,,	No. 1 ...	Goldfinder	7 0	3 5 0	
Aug., ,,	P.C. ...	,, ...	33 0	175 0 0	
Sep., ,,	...	,, ...	14 10	78 0 0	
Oct., ,,	P.C. ...	Hercules ...	3 5	9 0 0	
Feb., 1880	,, ...	Glen Mow-bray	15 0	22 0 0	
,, ,,	...	,, ...	15 10	62 0 0	
Aug., ,,	...	Hercules ..	17 0	22 18 0	

ROB ROY. *(Diagram No. 5.)*

Plan of Shafts on outcrop of Reef. Scale, 128 feet to an inch.

The above-mentioned plan of the shafts (attached hereto) was sketched in 1880 from measurements made on the ground and information supplied by the manager. The manager also gave me a plan of the workings in No. 2 East by Mr. Viewville, which is here reduced to the same scale. The workings in No. 1 East are added from the manager's information. (*Diagram No. 6.*)

I visited the workings in the engine shaft in December, 1880. At the 120-feet level, after driving for 80 feet to the east-south-east, a good shoot of stone was met with, and it was worked up to the surface near the 62-feet shaft in No. 2 East.

The bottom (200 feet) level was driven about 20 feet west-north-west, when the reef decreased from 2 feet thick to a mere wedge. Another level was driven to the east about 40 feet in a "blank," *i.e.* the reef was composed of gangue only. At the end of the 40-feet, a "feather-edge" of quartz comes in. The quartz is visible in the roof of the level for 30 feet further, and bulges to 9 inches in places. It yields 15 dwts. to the ton. At the end of the 30-feet the stone bulges to 2½ feet, and it maintains this thickness to the end of the level (8 feet further). Although the edge of the same shoot, which proved so rich in the No. 2 East, had, in all probability, been reached in the bottom level of the engine shaft, the latter was very unfavourably situated for economical working, and the mine abandoned shortly after my visit. The main body of the shoot is probably further east—in fact, the shoot seems to be more nearly vertical than the owners of the No. 1 claim imagined, and all their calculations were based on the supposition that the shaft would bottom on the shoot.

ROB ROY CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.	Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.				tns. cwt.	oz. dwt. gr.	£ s. d.
Feb., 1877	P.C. ...	Welcome...	68 0	136 0 0		Jan., 1878	No. 2 E.	Vulcan ...	190 0	401 0 0	
,, ,,	No. 2 E.	,, ...	37 0	171 0 0		Feb., ,,	...	,, ...	40 0	31 15 0	
Mar., ,,	No. 1 W.	,, ...	40 0	28 0 0		July, ,,	P.C. ...	,, ...	220 0	200 15 0	
,, ,,	No. 1 E.	,, ...	50 0	48 0 0		Jan., 1879	,, ...	,, ...	73 0	41 0 0	
June ,,	P.C. ...	Vulcan ...	104 0	96 0 0		July, ,,	Tribute	,, .	30 0	13 0 0	
,, ,,	No. 1 W.	,, ...	28 0	15 5 0		Sep., ,,	No. 1 W.	,, .	9 0	6 0 0	
Jan., 1878	P.C. ...	,, ...	250 0	292 16 0		Dec., ,,	P.C. ...	,, .	299 0	390 0 0	

ROB

ROB ROY CRUSHINGS—*continued.*

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
Feb., 1880	No. 1 W.	...	79 0	52 0 0	
,, ,,	Tribute	,, ...	137 0	294 0 0	
July ,,	P.C. ...	,, ...	300 0	247 0 0	
,, ,,	No. 1 ...	,, ...	247 0	181 0 0	
Oct., ,,	...	,, ...	54 0	130 15 0	
Dec., ,,	No. 1 ...	,, ...	22 0	48 0 0	
Jan., 1881	...	,, ...	150 0	68 0 0	
June, ,,	...	,, ...	35 0	34 19 0	
Aug., 1881	...	Vulcan ...	67 0	40 0 0	
Feb., 1882	...	,, ...	8 13	7 15 0	
May, ,,	...	,, ...	13 5	7 4 0	
June, ,,	...	,, ...	13 10	5 2 0	
Jan., 1883	...	,, ...	12 0	5 13 0	
Feb., ,,	No. 1 W.	,, ...	52 16	53 9 0	
Mar., ,,	...	,, ...	14 17	13 7 0	
Aug., ,,	...	,, ...	24 5	12 13 0	

GARRY OWEN.

This reef strikes north west and south-east and underlies to the south-west. It has been worked a good deal opencast. The present main working is from a vertical shaft which, at the depth of 60 feet, cuts the reef at 90 feet from its cap. The shaft has been sunk 10 feet more on the underlie. The country is hard greywacke. The reef averages 18 inches in thickness, with quartz generally in the foot-wall. Near the bottom, however, the quartz is on the hanging wall, and it has enlarged from a mere "feather-edge" to 3 inches in thickness.

GARRY OWEN CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
May, 1877	P.C. ...	Vulcan ...	13 0	15 0 0	
Oct., 1879	...	,, ...	10 0	12 0 0	
May, 1883	...	,, ...	10 12	10 0 0	

GUSTAVUS ADOLPHUS CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
April, 1877	P.C. ...	Welcome (Kingsboro')	75 0	165 12 0	
Feb., 1878	...	Vulcan ...	327 0	400 0 0	

GUSTAVUS ADOLPHUS CRUSHINGS—*continued.*

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
April, 1878	...	Vulcan ...	18 0	8 0 0	
July, ,,	P.C. ...	,, ...	314 0	413 0 0	
Nov., ,,	...	,, ...	81 0	92 0 0	
Feb., 1879	P.C. ...	,, ...	58 0	40 0 0	
Mar., 1880	...	,, ...	13 10	8 19 0	
Sep., ,,	...	,, ...	6 0	6 13 0	
Oct., ,,	...	,, ...	46 0	49 0 0	
Jan., 1883	...	,, ...	9 2	1 19 0	

TYRCONNEL. (*Diagram No. 7.*)

I visited this mine in November, 1880, and October, 1883.

The reef runs west-north-west, and underlies to the south-south-west at 65 degrees down to the 90-feet level, and thence to the bottom (414 feet) at 80 degrees.

The cap, so far as it is now visible, gives little indication of the importance of the reef. It is seen crossing the road to the north-west of the engine-house, and in some shafts on the north-west side of the road. In both, although the gangue of black shaley material is 9 feet thick, the quartz is limited to a few inches. Towards the engine-shaft the quartz thickened enormously.

In November, 1880, I found that the workings had come down to the 150-feet level (as in plan), but the shaft had been sunk to the depth of 180 feet. At the then bottom of the shaft the reef was 18 or 20 feet wide on the north-west side, and consisted of good streaky white quartz with a "horse" of shaley "country," which, however, did not extend to the other side of the shaft where the reef was all quartz but only 15 feet wide. Gold appeared freely in the quartz, especially in the neighbourhood of faces and joints parallel to the course of the reef. At the 90-feet level the quartz thinned out to 3 feet at 66 feet to the north-west of the shaft. It also narrowed to the south-east, but less rapidly. The north-west drive at the level of 90 feet had been carried 100 feet from the shaft. At the extremity the reef showed about 3 feet of gangue on the footwall, under 3 feet of rather poor white quartz. From the 150-feet level, which was carried to the south-east of the shaft to within 15 feet of the boundary, 500 tons had been taken out, which yielded 1,524 ounces of gold.

As will be seen from the crushings returns, an enormous quantity of gold was obtained from the portion of the reef worked up to the date of my first visit. Thus from 103, 500, 128, and 558 tons crushed in April 1877, June 1878, February 1879, and August 1880, 372, 1,524, 424, and 1,049 ounces; in all 3,369 ounces from 1,289 tons, were obtained—an average of 2½ ounces per ton. This was taken out from an area of reef which I estimate at 13,380 square feet. Since the mine passed into the hands of a Limited Liability Company, from an area of 10,210 feet there have been taken 3,728 tons, which have yielded 3,844 ounces of gold—an average of a trifle over an ounce. The cost of mining had, of course, increased with the increase in depth from the 150-feet level to the 340-feet level.

When I visited the mine in October, 1883, I was informed that the stone in the stope to the north-west of the shaft above the 236-feet level had given poor results (371 ounces from 435 tons=17 dwts. per ton). Near the end of the level a streaky reef is seen on the footwall, 18 or 20 inches thick. At the very end, however, it pinches a good deal. A large "horse" comes in and divides the reef on the footwall from a barren reef 2 feet in thickness.

In the 340-feet level the stone was about 4 feet thick, as far as the winze. There the hanging-wall suddenly disappeared, and about 3 feet of greywacke "country" came down almost to the footwall. From this to the end of the level the reef was only traceable by its dark shaley gangue. Up the face of the stope I saw a large "gangue" nearly 12 feet thick in places, with frequent "horses" and zig-zag intrusions of the greywacke from the hanging-wall side. Near the north-west end the roof showed about 18 inches of good seamy stone on the footwall, some 4 feet of dark shaley gangue, veined with a network of quartz, and lastly a few inches of good stone near the hanging wall. At the upper extremity of the stope the stone was nearly cut out by the closing-in of the hanging-wall.

The

The shaft was being sunk below the 340-feet level, and had reached 380 feet at the date of my second visit. The "country" was black shale and a little greywacke. For 20 feet below the level there was nothing but black slatey gangue, then on the eastern side of the shaft a mass of quartz came in, 2 feet 6 inches wide. At 40 feet the quartz had crossed to the other side of the shaft, and was 3 feet wide. The lower half was the better stone, but none of it prospected very well. On revisiting the shaft on 17th December, I found that the quartz had pinched out at 60 feet below the level. The shaft was then down to 414 feet. At the bottom, on the east side, a vein of quartz, about 1 foot thick, had come in. The 340-feet level had been continued a little further than it was on my previous visit, and some stone had been met with. Good stone, I was informed, was being got from the stope above this level.

TYRCONNEL CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
Feb., 1877	No. 1 N.	Brisbane...	40 0	107 5 0	3 7 4
,, ,,	No. 2 S.	,, ...	29 0	58 7 0	2 18 0
April, ,,	P.C. ...	,, ...	103 0	372 10 0	
May, ,,	Surface	,, ...	93 0	103 16 0	
,, ,,	No. 1 S.	,, ...	102 0	220 0 0	
July, ,,	No. 1 ...	,, ...	63 10	44 18 0	
Aug., ,,	Surface	,, ...	20 0	10 4 18	
Jan., 1878	No. 1 N.	,, ...	16 0	14 2 0	
Mar., ,,	Surface	,, ...	40 0	57 3 0	
June, ,,	No. 2 N.	,, ...	3 15	16 11 0	
,, ,,	P.C. ...	Vulcan ...	500 0	1524 0 0	
July, ,,	Surface	Brisbane...	12 0	10 0 0	
,, ,,	No. 3 S.	,, ...	20 0	16 0 0	
,, ,,	No. 2 N.	,, ...	2 0	2 10 0	
Jan., 1879	No. 1 N.	,, ...	50 0	81 0 0	
Feb., ,,	P.C. ...	Vulcan ...	128 0	424 0 0	
Mar., ,,	No. 1 S.	Brisbane...	326 10	286 17 0	
April, ,,	P.C. ...	,, ...	650 0	1725 17 0	
June, ,,	T. and Lizzie Redmond	,, ...	748 15	1774 3 0	
Sep., ,,	P.C. ...	,, ...	446 0	971 0 0	
Mar., 1880	,, ...	,, ...	853 0	1127 8 0	
April, ,,	No. 2 S.	,, ...	19 10	32 0 0	
,, ,,	No. 1 S.	,, ...	184 10	211 0 0	
July, ,,	,,	,, ...	98 0	155 10 0	
,, ,,	...	,, ...	520 0	1050 0 0	
,, ,,	P.C. ...	,, ...	604 15	1486 0 0	
Aug., ,,	,, ...	Vulcan ...	558 0	1049 0 0	
Oct., ,,	No. 1 ...	Brisbane...	80 0	102 7 0	
Jan., 1881	P.C. ...	,, ...	370 0	376 0 0	
May, ,,	No. 1 ...	,, ...	96 0	134 8 0	
Aug., ,,	,, ...	,, ...	122 0	75 7 0	
,, ,,	Lease ...	Vulcan ...	94 0	123 0 0	
Feb., 1882	No. 1 S.	Brisbane...	23 10	14 10 0	

TYRCONNEL CRUSHINGS—*continued.*

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
Feb., 1882	Lease ...	Vulcan ...	538 0	758 0 0	
April, ,,	,, ...	,, ...	470 0	510 0 0	
May, ,,	..	,, ...	192 0	242 0 0	
June, ,,	...	,, ...	464 11	563 17 0	
Sep., ,,	No. 1 ...	,, ...	33 1	35 6 0	
,, ,,	Lease ...	,, ...	435 10	371 14 0	
Feb., 1883	,, ...	,, ...	171 0	165 4 0	
Mar., ,,	...	,, ...	562 12	380 0 0	
May, ,,	Lease ...	,, ...	163 0	141 4 0	
Aug., ,,	...	,, ...	729 5	569 12 0	

COMMODORE CRUSHINGS.

Feb., 1877	No. 1 W.	Brisbane...	31 0	57 17 0	3 9 9
April, ,,	No. 2 S.	Hercules...	12 0	7 15 0	
,, ,,	P.C. ...	,, ...	46 0	85 14 0	
July, ,,	,, ...	Brisbane...	60 13	59 14 0	
,, ,,	No. 1 ...	,, ...	110 7	105 0 0	
Nov., ,,	No. 1 N.	,, ...	10 10	28 3 6	
Jan., 1878	No. 1 E.	,, ...	77 10	200 0 0	
Feb., ,,	No. 1 S.	,, ...	77 4	96 10 0	
,, ,,	No. 2 W.	,, ...	4 9	3 0 0	
May, ,,	P.C. ...	,, ...	41 0	78 0 0	
June, ,,	No. 1 S.	,, ...	170 0	109 16 0	
July, ,,	No. 1 W.	,, ...	25 0	25 7 0	
Aug., ,,	No. 1 S.E.	,, ...	33 0	74 10 0	
Oct., ,,	No. 1 S.	,, ...	12 0	24 0 0	
June, 1879	P.C. ...	,, ...	108 15	144 0 0	
July, 1880	,, ...	,, ...	25 10	49 17 0	
Aug., ,,	...	,, ...	25 0	49 6 0	
Oct., ,,	...	,, ...	40 0	22 18 0	
Sep., 1882	...	Vulcan ...	44 13	79 10 0	
Mar., 1883	P.C. ...	,, ...	99 17	117 15 0	
Aug., ,,	...	,, ...	39 10	31 13 0	

LIZZIE REDMOND.

I visited this reef in October, 1883. It strikes north-west and south-east, and underlies at 75 degrees to the south-east. It was then worked in an underlie shaft 50 feet deep. The quartz was nearly 5 feet thick. The hanging-wall was very distinct, and was partly of quartz. The reef was formerly worked to the south-east of the shaft for a distance of about 100 feet, and to a depth of 24 feet. A parallel reef is seen south-east of the shaft, overlying the principal reef.

LIZZIE REDMOND CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz
			tns. cwt.	oz. dwt. gr.	£ s. d.
April, 1877	P.C. ...	Brisbane...	105 18	401 18 0	
May, 1878	No. 1 E.	,, ...	6 0	30 0 0	
June, ,,	,, ...	,, ...	5 0	5 0 0	
,, ,,	...	,, ...	260 0	526 0 0	
Sept., ,,	P.C. ...	,, ...	66 5	134 0 0	
April, 1880	No. 1 S.	,, ...	30 15	37 0 0	
June, ,,	P.C. ...	,, ...	47 0	105 0 0	
Jan., 1881	...	,, ...	205 0	169 10 0	
April, ,,	No. 1 S.	,, ...	50 0	151 0 0	
,, ,,	P.C. ...	,, ...	32 0	22 0 0	
Aug., ,,	...	Vulcan ...	12 10	35 10 0	
Jan., 1882	No. 1 ...	Brisbane...	80 0	124 0 0	
May, ,,	P.C. ...	Vulcan ...	74 3	87 5 0	
Sep., ,,	...	,, ...	202 5	352 6 0	
Aug., 1883	...	,, ...	150 2	95 9 0	

HERO CRUSHINGS.

Feb., 1877	P.C. ...	Hercules...	75 16	243 13 0	3 9 6
Jan., 1878	No. 1 ...	,, ...	8 5	5 6 0	
Feb., ,,	P.C. ...	,, ...	138 0	150 5 0	
July, ,,	,, ...	Brisbane...	55 0	207 14 0	
Sep., ,,	,, ...	,, ...	51 10	77 16 0	
April, 1880	,, ...	,, ...	178 15	239 0 0	
Aug., ,,	...	,, ...	52 0	109 10 0	
April, 1881	P.C. ...	,, ...	143 0	224 0 0	
Jan., 1883	,, ...	Vulcan ...	95 14	90 15 0	
May, ,,	,, ...	,, ...	28 0	8 11 0	

COLUMBIA CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
Mar., 1877	P.C. ...	Hercules...	98 0	179 8 0	
Aug., ,,	,, ...	,, ...	95 0	79 3 0	
Jan., 1878	No. 1 W.	,, ...	32 0	81 14 0	
Mar., ,,	P.C. ...	Brisbane...	42 7	108 12 20	
July, ,,	,, ...	,, ...	80 0	103 0 0	
Aug., ,,	No. 1 S.E.	,, ...	7 0	18 6 0	
Nov., ,,	P.C. ...	,, ...	90 0	57 10 0	
Oct., 1880	...	,, ...	18 0	40 14 0	
April, 1881	P.C. ...	,, ...	32 0	78 0 0	

EL DORADO CRUSHINGS.

Feb., 1877	P. C. ...	Brisbane...	47 0	177 17 0	3 9 11
Aug., ,,	,, ...	Hercules...	11 10	24 8 0	
Jan., 1878	...	Brisbane...	38 18	228 5 0	
June, ,,	P.C. ...	Hercules...	12 10	40 4 0	
July, ,,	No. 1 N.	Brisbane...	4 0	6 10 0	
Mar., 1879	P. C. ...	,, ...	24 0	50 0 0	
July, ,,	,, ...	,, ...	15 14	85 0 0	
Oct., ,,	,, ...	Hercules...	14 0	23 0 0	

HONEST LAWYER CRUSHINGS.

Feb., 1877	No. 1 S.W.	Brisbane...	12 0	16 1 0	3 5 0
Mar., ,,	P. C. ...	,, ...	25 0	62 5 0	
May, ,,	No. 1 S.E.	Hercules...	78 10	157 0 0	
July, ,,	P. C. ...	Brisbane...	15 0	13 5 0	
Feb., 1878	No. 1 N.	,, ...	21 11	17 0 0	

HONEST LAWYER CRUSHINGS—*continued.*

Date.	Part of Reef.	Machine.	Quartz Crushed. tns. cwt.	Yield of Gold. oz. dwt. gr.	Value of Gold per oz. £ s. d.
Mar., 1878	No. 2 N.	Brisbane ...	62 0	95 12 0	
April, ,,	No. 2 ...	,, ...	88 10	37 2 12	
July, 1879	...	,, ...	31 13	48 0 0	
Sept., ,,	...	Hercules ...	6 10	16 15 0	
Dec., ,,	P. C. ...	Brisbane ...	6 0	27 10 0	
June, 1880	...	,, ...	22 0	47 0 0	
Jan., 1881	...	,, ...	26 0	97 0 0	
Sept., 1882	...	Hercules ...	91 0	46 5 0	
May, 1883	...	,, ...	45 0	44 0 0	

HENRY GRATTAN CRUSHINGS.

April, 1877	P.C. ...	Brisbane ...	48 0	696 0 0	
June, 1878	No. 1 E.	,, ...	13 0	29 15 0	
May, ,,	P.C. ...	,, ...	70 0	322 0 0	
Jan., 1880	P.C. ...	,,	57 7	380 6 0	
July, ,,	...	,,	46 15	90 0 0	

FOURTH OF JULY CRUSHINGS.

Feb., 1877	P.C. ...	Brisbane ...	25 0	154 0 0	3 8 8
Mar., ,,	No. 2 W.	Hercules ...	30 0	5 14 2	
May, ,,	...	,, ...	32 0	23 3 0	
,, ,,	No. 1 E.	,, ...	25 0	18 0 0	
July, ,,	P.C. ...	,, ...	15 0	24 9 0	
Jan., 1878	No. 1 E.	Brisbane ...	8 0	16 0 0	
,, ,,	No. 1 W.	,, ...	12 15	26 5 0	
Feb., ,,	P.C. ...	,, ...	8 0	16 7 0	
,, ,,	No. 1 E.	,, ...	15 18	70 10 0	
May, ,,	No. 1 S.	,, ...	30 0	21 1 6	
July, ,,	P.C. ...	,, ...	17 0	54 2 0	
Aug., ,,	Surface	,, ...	25 0	14 0 0	
,, ,,	No. 1 S.	,, ...	4 15	14 3 0	
Nov., ,,	No. 1 N.	,, ...	9 5	9 0 0	
,, ,,	P.C. ...	,, ...	37 10	47 0 0	
Jan., 1879	No. 1 N.	,, ...	26 14	15 14 0	
,, ,,	,, ,,	,, ...	17 12	11 13 0	
,, ,,	P.C. ...	,, ...	13 18	12 18 0	
Mar., ,,	No. 1 N.	,, ...	5 5	5 15 0	
Oct., ,,	No. 1 W.	,, ...	22 10	35 0 0	
,, ,,	P.C. ...	,, ...	28 0	24 0 0	
July, 1880	,, ,,	,, ...	85 0	40 10 0	
Sep., ,,	...	,, ...	35 0	34 3 0	
Aug., 1883	...	Vulcan ...	8 0	7 6 0	

MOWBRAY CRUSHINGS.

Aug., 1877	P.C. ...	Brisbane ...	59 8	121 6 0	
June, 1878	,, ...	,, ...	25 0	66 0 0	
Oct., ,,	Surface	,, ...	20 0	5 0 0	
Jan., 1879	Lease No. 8	,, ...	36 6	234 0 0	
Sep., ,,	,,	Hercules ...	143 0	286 10 0	
Jan., 1880	,,	Brisbane ...	47 0	229 15 0	
June, ,,	P.C. ...	,, ...	41 0	56 0 0	
Sep., ,,	...	,, ...	57 10	23 5 0	
May, 1881	...	Mowbray	not giv'n	35 12 0	

ALLIANCE CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed. tns. cwt.	Yield of Gold. oz. dwt. gr.	Value of Gold per oz. £ s. d.
Feb., 1877	P.C. ...	Thornboro'	26 9	63 0 0	3 1 0
Jan., 1878	,, ...	Brisbane	40 0	63 17 0	
June, ,,	,, ...	,,	20 0	73 16 0	
Jan., 1879	Lease No. 9	,,	16 0	21 10 0	
April, ,,	P.C. ...	Hercules ...	54 0	40 13 0	
Sep., ,,	Lease ...	Brisbane ...	9 0	7 0 0	
Jan., 1880	P.C. ...	,, ...	9 10	14 0 0	

EMPRESS OF INDIA CRUSHINGS.

Feb., 1877	P.C. ...	Hercules ...	92 0	159 0 0	2 19 10
July ,,	,, ...	,, ...	32 0	128 5 0	
,, ,,	No. 3 ...	,, ..	18 0	112 11 0	
Aug., ,,	No. 3 S.	,, ...	4 10	4 14 0	
Jan., 1878	P.C. ...	,, ...	41 0	124 15 0	
Feb., ,,	No. 3 ...	...	68 0	118 8 0	
,, ,,	P.C. ...	...	51 10	301 0 0	
June, ,,	No. 3 S.	...	11 10	21 7 0	
Aug., ,,	Nos. 1 and 2 S. United	Brisbane ...	24 0	62 0 0	
Nov., ,,	Lease ...	,, ...	3 10	6 10 0	
Mar., 1879	No. 3 S.	Hercules ...	46 0	121 10 0	
April, ,,	P.C. ...	,, ...	121 0	397 5 0	
July, ,,	,, ...	Brisbane ...	37 0	109 0 0	
Oct., ,,	No. 3 ...	,, ...	12 5	6 0 0	
,, ,,	P.C. ...	Hercules ...	42 0	115 5 0	
,, ,,	Nos. 1 and 2	,, ...	4 0	9 0 0	
Mar., 1880	P.C. ..	,, ...	60 10	98 8 0	
April, ,,	Nos. 1 and 2	Brisbane ...	7 0	4 14 0	
June, ,,	P.C. ...	Hercules ...	2 10	0 13 0	
,, ,,	...	Brisbane ...	10 10	11 0 0	
July, ,,	P.C. ...	Hercules ...	30 10	47 4 0	
,, 1881	...	Brisbane ...	17 0	27 6 0	
Feb., 1882	...	,, ...	22 0	28 0 0	

CORNWALL AND DEVON CRUSHINGS.

Jan., 1877	No. 1 ...	Hercules ...	7 10	89 10 0	2 12 11
,, ,,	P.C. ...	,, ...	11 15	51 15 0	3 1 10
Mar., ,,	No. 2 ...	,, ...	15 0	13 15 0	
May, ,,	...	,, ...	20 0	45 0 0	
June, ,,	P.C. ...	,, ...	39 10	36 6 0	
July, ,,	No. 2 ...	,, ...	11 0	8 19 0	
Aug., ,,	P.C. ...	,, ...	4 10	9 0 0	
Dec., ,,	...	,, ...	24 5	74 6 0	
Feb., 1878	No. 1 ...	,, ...	39 0	219 10 0	
Mar., ,,	No. 1 N.	,, ...	9 15	76 9 0	
,, ,,	No. 2 N.	,, ...	3 0	13 0 0	
June, ,,	P.C. ...	,, ...	15 15	9 7 0	
,, ,,	No. 1 S.	,, ...	7 10	24 10 0	
Feb., 1879	No. 1 N.	,, ...	29 15	166 0 0	
Sep., ,,	...	,, ...	34 0	87 5 0	
Oct., ,,	...	,, ...	8 10	12 10 0	
,, ,,	North ...	,, ...	14 10	31 11 0	
Aug., 1880	...	,, ...	20 0	81 8 0	
April, 1881	...	,, ...	47 0	47 15 0	

GREAT NORTHERN CRUSHINGS.

Mar., 1877	P.C. ...	Hercules ...	50 0	152 19 0	
Feb., 1878	...	,, ...	173 10	111 8 0	
June, ,,	P.C. ...	,, ...	7 10	10 7 0	
Aug. ,,	,, ...	Brisbane ...	6 15	23 4 0	
Jan., 1879	,, ...	Hercules ...	16 5	44 10 0	
June, ,,	,, ...	,, ...	5 15	6 15 0	
Oct., ,,	,, ...	,, ...	20 0	11 0 0	

EXPLORER. (*Diagram No.* 8.)

Strike north 6 degrees east. Underlie west 6 degrees north at 65 degrees. This may be taken as a type of the reefs which do not coincide with the strike of the "country" rock.

I visited the reef in October, 1880. It was abandoned shortly after.

I went down the creek shaft. At 14 feet deep the reef was 2 feet thick (all taken out) at south end of shaft. At 3 feet north of the north end of the shaft the reef "cut out," but the gold continued in clay leaders. At the depth of 30 feet the reef (all taken out) was 3½ feet thick, but was almost all shaley gangue.

At the bottom of the shaft (45 feet deep) there was a drive to the east for 50 feet. Here the reef cut out. Another drive went to the north about 45 feet. At the end it caught a shoot of stone, which was followed down on its underlie (to the north) as far as the bottom of the vertical portion of the engine shaft, and upwards to the surface near the top of the creek shaft.

The engine shaft is 80 feet vertical, and 57 feet on the underlie. At 25 feet down the underlie a drive has been carried 33 feet to the north. Here the last payable quartz was obtained. A drive was made to the north from the foot of the underlie shaft; but although it was carried 67 feet—*i.e.*, beyond where the shoot of rich stone should have come, it was not met with. Quartz was obtained, but it carried only a very small proportion of gold—about 2 dwts. to the ton. The previous average had been nearly 5 ounces to the ton.

EXPLORER

EXPLORER CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
Jan., 1877	P.C. ...	Hercules...	60 0	401 17 0	3 3 5
Sep., ,,	,, ..	,, ...	57 10	498 15 0	
Dec., ,,	...	,, ...	34 0	47 18 0	
Mar., 1878	P.C. ...	,, ...	161 10	651 0 0	
June, ,,	...	,, ...	121 10	806 3 0	
July, ,,	,, ...	,, ...	92 0	230 0 0	

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
Jan., 1879	P. ...	Hercules...	83 10	95 12 0	
April, ,,	,, ...	,, ...	11 0	11 9 0	
Oct.,	,, ...	,, ...	11 5	35 15 0	
Feb., 1880	...	Glen Mowbray	6 0	21 10 0	
June, ,,	P.C. ...	Hercules...	51 0	4 19 0	

* Principally seconds.

TICHBOURNE. (*Diagram No.* 9.)

The sketch attached hereto shows the mode of occurrence of the shoot of auriferous quartz in the above mine. It began at 53 feet down the underlie shaft. In a drive to the south, at the 155-feet level, it was 30 feet to the outer edge of the shoot. A little deeper the shoot had passed out of the shaft to the north. The shaft was continued 100 feet further on the underlie (to east 15 degrees north at 45 degrees). A vertical shaft was sunk which cut the reef at 110 feet deep, 25 feet to the north of the underlie shaft at the 155-feet level, and was continued on the underlie to 130 feet. But below the point where the vertical shaft "bottomed" on the reef the stone shortly died out. Above this, in the workings connected with the main underlie shaft, about 800 tons, yielding as high as 3½ ounces, and averaging nearly 2 ounces, were obtained; but below this, under 100 tons were obtained, and the yield was under 1 ounce to the ton. From the data above given, it may be inferred with confidence that the shoot of stone was about 64 feet in width, and extended downward to about 170 feet. The underlie shaft of the Tichbourne is only 50 feet from the point where the cap of the reef intersects the cap of the Pioneer Reef. The latter is not traced beyond this point, but the Tichbourne is continued as the "True Blue" to the north. It appears, therefore, that the Tichbourne (which crosses the strike of the strata) displaces or is newer than the Pioneer (which coincides with the strike of the strata).

TICHBOURNE CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
June, 1877	P.C. ...	Hercules...	53 0	62 3 0	
Jan., 1878	,, ...	,, ...	116 15	432 18 0	
June, ,,	,, ...	,, ...	29 10	32 0 0	
,, ,,	No. 1 N.	,, ...	94 0	222 7 0	
Mar., 1879	,,	,, ...	272 5	599 0 0	
,, ,,	,,	,, ...	15 0	45 0 0	
,, ,,	No. 1 S.	,, ...	19 0	14 13 0	
Aug., ,,	No. 1 ...	Goldfinder	144 0	133 0 0	
Sep., ,,	P.C. ...	,, ...	18 0	22 10 0	
Feb., 1880	...	Glen Mowbray	31 0	36 5 0	

TICHBOURNE CRUSHINGS—*continued.*

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
June, 1880	P.C. ...	Hercules...	36 0	36 0 0	
July, ,,	,, ...	,, ...	68 10	62 7 0	
,, ,,	...	,, ...	2 0	4 2 0	
June, 1881	...	,, ...	27 0	24 0 0	

TRUE BLUE CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
Feb., 1877	P.C. ...	Hercules...	10 9	22 16 0	2 16 2
April, 1878	,, ...	,, ...	6 0	9 4 0	
April, 1879	...	,, ...	12 0	43 3 0	
Oct., ,,	P.C. ...	,, ...	5 10	3 3 0	

PIONEER. (*Diagram No.* 10.)

Rough Plan of Cap of Reef.—Scale, 128 *feet to an inch.*

a. Shallow shaft.
b. Vertical shaft. Bottomed on reef at 60 feet. Reef not payable.
c. Underlie shaft 30 feet deep. Blocked out right and left, and on to shaft *d.* Reef, about 18 inches. About 60 tons crushed. Yield, about 3 ounces to the ton.
d. Underlie shaft; depth unknown. Worked to communicate with *c.* Gave 3½ ounces per ton. This was the first shaft sunk in the reef.
e. Underlie shaft met by vertical shaft *f,* and worked back to within a few feet of shaft *d,* and on to shaft *g.*
f. Vertical shaft. Only bottomed on reef. Depth unknown.
g. Underlie shaft about 12 feet deep. Reef ran out in bottom.
h. Underlie shaft about 25 feet deep. Good stone for first 6 or 7 feet only.
i. New underlie shaft, about 30 feet. For the first 12 feet there were 3 feet of gangue but only 1 inch of quartz. At about 20 feet, 5 inches of quartz on hanging-wall, and 4 inches on footwall. These shortly came together, and the reef bulges to 2 feet of solid quartz. In about 10 feet further it thins out to a few inches on the hanging-wall. There is a little galena in the stone, and some visible gold. The "country" is greywacke. The underlie of the reef is 50 degrees.
j. Underlie shaft, 60 feet deep. About 30 or 40 tons from surface, and from 20 feet deep, yielded 1 ounce 5 dwts. per ton. A large reef down to bottom of shaft. It was all crushed, but my informant could not tell me with what results.
k to *l.* Early opencast workings. No records.
m. Whip shaft about 200 feet on the underlie. Skids did not go at right angles to the strike of the reef, but a little to the east, which was understood (but wrongly, my informant believed) to be the run of the "shoot." Worked towards *n,* but not back towards *l.* Some crushings gave high returns, but the last from the bottom only gave 2 ounces for 20 tons.
n. Underlie shaft supposed about 100 feet deep. All worked out between this shaft and *m.* All that was raised from this shaft was good payable stone. Rich "surface" was got here at first
o. Opencast workings, 40 feet long. Very good stone. Quartz seen at surface 1 foot thick.
p. Shaft in No. 1 West. First crushing (7½ tons) gave nearly 6 ounces to the ton

I am indebted to Mr. Brown, one of the partners now working the claim on tribute, for the above particulars except as regards the present shaft (*i.*) and such of the surface workings as were accessible in December last.

PIONEER CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
Jan., 1877	P.C. ...	Hercules...	97 0	250 3 0	
,, 1878	,, ...	,, ...	50 0	36 18 0	
Mar., 1879	No. 1 W.	,, ...	7 10	44 0 0	
Aug., ,,	P.C. ...	Goldfinder	16 0	7 5 0	
Sep., ,,	,, ...	,, ...	23 0	43 0 0	
Oct., ,,	,, ...	Hercules...	21 0	68 12 0	
Mar., 1880	,, ...	,, ...	39 10	90 10 0	
,, ,,	,, ...	,, ...	27 0	12 17 0	
,, ,,	No. 2 ...	Glen Mowbray	10 0	10 0 0	
June, ,,	P.C. ...	Hercules...	45 0	83 0 0	
July, ,,	No. 1 W.	,, ...	6 10	32 0 0	
,, ,,	P.C. ...	,, ...	101 15	492 2 0	
,, ,,	,, ...	,, ...	2 0	4 2 0	
,, ,,	,, ...	,, ...	52 10	166 5 0	
Aug., ,,	West ...	,, ...	52 10	153 4 0	
Oct., ,,	P.C. ...	Mowbray	82 0	231 3 0	
Dec., ,,	...	,, ...	90 0	250 0 0	
,, ,,	East ...	Hercules...	238 0	296 12 0	
Dec., 1880	West ...	Hercules...	108 0	266 15 0	
Jan., 1881	P.C. ...	Mowbray	10 0	29 0 0	
April, ,,	West ...	Hercules...	24 0	46 13 0	
,, ,,	East ...	,, ...	38 0	59 8 0	
May, ,,	West ...	,, ...	140 0	211 3 0	
June, ,,	West ...	,, ...	138 0	200 0 0	
July, ,,	...	Mowbray	52 0	39 3 0	
Aug., ,,	East ...	...	34 0	50 8 0	
,, ,,	...	...	5 10	9 14 0	
Sep., ,,	...	...	34 0	56 0 0	
,, ,,	No. 1 ...	...	6 0	8 0 0	
,, ,,	,, ...	...	19 0	23 0 0	
,, ,,	Tribute	...	10 0	7 10 0	
April, 1882	P.C. ...	...	33 0	64 0 0	
,, ,,	West ...	...	24 0	45 0 0	
May, ,,	P.C. ...	...	70 0	96 0 0	
,, 1883	No. 1 ...	...	11 10	26 0 0	
,, ,,	...	...	20 0	2 0 0	
,, ,,	...	Hercules...	127 0	57 0 0	

HOPE.

The Hope Reef runs east-south-east to west-north-west, and underlies to south-south-west at 60 degrees. It has been worked opencast at the east-south-east end of the cap, and from two shafts; the first (eastmost) being 50 feet vertical and 110 feet on the underlie; the second (30 feet distant) being 25 feet vertical and 60 feet on the underlie. The stone was worked out between the two shafts. The crushings, it will be seen, were never large, but some of them were good.

HOPE CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
Jan., 1877	P.C. ...	X.L. ...	14 0	54 5 0	3 2 3
April, ,,	,, ...	,, ...	23 0	26 0 0	
Aug., 1878	,, ...	,, ...	9 0	27 0 0	
,, ,,	,, ...	,, ...	8 0	3 15 0	
Oct., 1879	,, ...	Hercules...	9 10	15 4 0	
Mar., 1880	,, ...	,, ...	20 15	49 8 6	
Aug., ,,	...	,, ...	1 13	2 2 0	

HOPE CRUSHINGS—*continued.*

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
Aug., 1880	...	Hercules...	30 0	14 8 0	
Sep., 1881	P.C. ...	Mowbray	33 0	84 0 0	

CHANCE CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
Feb., 1877	P.C. ...	Hercules...	16 0	22 16 0	2 13 11
Aug., ,,	,, ...	,, ...	30 0	22 4 0	

The tunnel already alluded to (p. 4) is designed to cut the Chance and Hope Reefs at a lower level than the old workings. It has already been carried 220 feet, and has apparently about 96 feet further to go to catch the Hope, as the section attached will show (*Diagram No.* 11).

IDAHO.

Underlies at 45 degrees to west-north-west. It has been worked in an underlie shaft 100 feet deep. At the bottom the reef is 18 inches thick, all quartz. Both walls are well defined. The "country" is very hard siliceous grit, with pebbles and boulders of black shale. The stone at the bottom is poor. The quartz was worked out about 18 feet on both sides of the shaft. It varied from a few inches up to 18 inches thick.

IDAHO CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
Apr., 1878	P. C ...	Hercules...	35 10	14 0 0	
June, ,,	,, ...	,, ...	7 0	16 4 0	
,, ,,	,, ...	,, ...	9 0	16 4 0	
July, ,,	,, ...	,, ...	10 10	37 7 0	
Mar., 1879	,, ...	,, ...	25 15	49 15 0	
Apr., 1881	...	,, ...	16 0	15 7 0	
May, 1881	...	Hercules...	16 0	8 7 0	
June ,,	...	,, ...	28 0	17 0 0	
Sept. ,,	...	Mowbray	8 0	24 0 0	
Oct., ,,	...	,, ...	8 0	22 14 0	
May, 1883	...	Hercules...	31 0	64 0 0	

MAORI CHIEF.

The principal working was a whip shaft 160 feet deep. There was a narrow shoot of gold, little wider than the breadth of the shaft. The quartz was wider, but did not contain gold beyond the above limits. At the bottom the auriferous stone was only three feet wide, and the last crushings were comparatively poor.

MAORI

MAORI CHIEF CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.	Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.				tns. cwt.	oz. dwt. gr.	£ s. d.
Jan., 1877	P. C. ...	Hercules...	43 15	131 0 0	3 2 6	Apr., 1879	P.C. ...	Hercules...	31 0	61 0 0	
June, „	„ ...	„ ...	74 0	150 10 0		Oct., „	„ ...	„ ...	14 0	23 0 0	
Feb., 1878	„ ...	„ ...	41 0	99 5 0		„ „	„ ...	„ ...	6 15	9 5 0	
„ 1879	„ ...	„ ...	41 0	145 0 0							

KINGSBOROUGH.

Prospecting Claim.—This is a continuation of the Maori Chief. The principal workings were confined to one shaft 80 to 100 feet deep. As will be seen from the returns, the crushings were large, and averaged 4½ ounces to the ton. The deep ground, however, is said not to have been payable. The last two crushings were certainly small and poor.

No. 1 or Flying Pig.—This claim was worked to the depth of 60 feet over the whole ground (about 120 feet long). The sketch attached illustrates the position of the several shafts; the information regarding them was furnished by Mr. Brown. (*Diagram No. 12.*)

Plan of Shafts on Flying Pig Claim.—Scale, 128 feet to an inch.

a. Underlie shaft. It was from this shaft and its connection with *b* that the extraordinary crushings which have made the Flying Pig famous were obtained. 55 tons yielded 1,075 ounces of gold, 83 tons 1,069½ ounces, and 271 tons 892 ounces 15 dwts. The underlie is 45 degrees.

b. Shaft 80 feet vertical and connected with *a.* The auriferous stone in the workings of this shaft and shaft *a* averaged 18 inches thick and 30 feet wide, althou the quartz was much wider. Shaft *b* bottomed in the middle of the shoot which started at *a*, but on following the underlie of the reef from the bottom of the vertical shaft the shoot was left on the north-east side.

c. Shaft cutting the reef at 25 feet. No quartz.

d. Shaft 20 feet vertical and 40 feet on underlie. Fair stone, but only in patches.

e. Opencast workings.

f. Shaft 30 feet vertical and 40 feet on underlie. Stone only in patches.

g. Shaft 14 feet vertical, and 60 feet on underlie. Stone in patches. A crushing of 21 tons for 60¼ ounces came from this shaft.

No. 2 Kingsborough.—In this claim a vertical shaft was sunk 200 feet in search of the reef, but did not bottom as it was not deep enough.

KINGSBOROUGH CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
Jan., 1877	P.C. ...	Hercules...	84 0	748 0 0	3 1 10
Feb., „	No. 1 N.	„ ...	55 0	1075 0 0	3 0 0
June, „	No. 1 ...	„ ...	83 0	1069 10 0	
Mar., 1878	No. 1 N.	„ ...	271 0	892 15 0	
June, „	No. 1 N. (headings)	„ ...	4 0	4 0 0	
July, „	P.C. ...	„ ...	39 15	156 10 0	
„ „	No. 1 N.	„ ...	78 15	130 17 0	
April, 1879	„	„ ...	31 10	71 16 0	
„ „	P.C. ...	„ ...	73 15	119 0 0	
Sep., „	...	„ ...	14 10	57 10 0	
Oct., „	No. 1 N.	„ ...	49 10	136 11 0	
Mar., 1880	P.C. ...	„ ...	16 0	31 16 0	
July, „	No. 1 N.	„ ...	89 0	209 0 0	
May, 1881	...	„ ...	5 0	3 15 0	
June, „	P.C. ...	„ ...	7 0	4 5 0	
July, „	No. 1 ...	Mowbray	21 0	60 10 0	
Mar., 1883	„ ...	„ ...	29 0	47 0 0	
May, „	„ ...	Hercules...	14 0	26 10 0	
„ „	P.C. ...	„ ...	9 0	9 0 0	

ACE OF HEARTS CRUSHINGS.

Feb., 1877	P.C. „	Brisbane...	39 0	64 18 0	3 3 8
Aug., „	„ ...	„ ...	81 0	96 16 0	
June, 1878	„ ...	„ ...	7 0	16 0 0	
July, „	„ ...	„ ...	16 0	16 10 0	
Sep., „	„ ...	„ ...	29 0	15 0 0	
Oct., „	„ ...	„ ...	7 10	4 5 0	
July, 1881	„ ...	„ ...	24 0	22 13 0	
Feb., 1882	„ ...	„ ...	43 0	41 0 0	
Sep., „	„ ...	Hercules...	38 0	40 1 0	

AMENDMENT CRUSHINGS.

Jan., 1878	P.C. ...	Hercules...	21 0	21 10 0	
April, „	„ ...	Thornboro'	8 0	5 5 0	

ARIEL CRUSHINGS.

Mar., 1878	P.C. ...	Goldfinder	49 0	9 19 0	

ARISTOCRAT CRUSHINGS.

April, 1878	P.C. ...	Kingsboro'	37 0	35 15 0	
June, 1879	„ ...	Vulcan ...	13 0	20 0 0	
Nov., „	„ ...	„ ...	5 0	2 15 0	

ALBION CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
Nov., 1878	P.C. ...	Vulcan ...	40 0	40 0 0	
Feb., 1880	„ ...	Pers'ver'nce	18 5	9 11 0	
May, „	„ ...	„ ...	20 7	7 12 0	
„ „	No. 1 ...	„ ...	5 5	2 2 0	
Sep., „	P.C. ...	„ ...	22 0	9 5 0	
Nov., „	„ ...	„ ...	31 0	18 1 0	
Aug., 1881	„ ...	„ ...	10 10	6 0 0	

BAND OF HOPE CRUSHINGS.

Mar., 1878	...	X.L., Glen Mowbray	6 0	3 11 0	

BIRMINGHAM CRUSHINGS.

Jan., 1877	No. 1 ...	Hercules...	5 0	17 15 0	2 17 3
Feb., „	P.C. ...	„ ...	15 10	12 15 0	2 10 0
July, „	„ ...	„ ...	5 0	20 19 0	
June, 1878	No. 1 N.	„ ...	4 0	26 10 0	
Mar., 1879	No. 2 ...	„ ...	19 10	28 8 0	

BRIGHT SMILE CRUSHINGS.

Jan., 1878	P.C. ...	Hercules...	22 0	70 15 0	

BOOMERANG CRUSHINGS.

Feb., 1878	...	Goldfinder	29 10	20 6 12	

BETTER LUCK CRUSHINGS.

Feb., 1878	...	Goldfinder	14 10	21 15 12	

BLACK DIAMOND CRUSHINGS.

Jan., 1880	...	Pers'ver'nce	116 0	108 0 0	
April, „	P.C. ...	„ ...	8 0	8 6 0	
May, „	P.C. ...	„ ...	21 0	12 0 0	
Sep., „	...	„ ...	81 0	26 5 0	
Nov., „	P.C. ...	„ ...	10 10	9 14 0	

CONTEST CRUSHINGS.

April, 1877	P.C. ...	Hercules...	72 0	91 15 0	
Aug., 1878	„ ...	Brisbane...	15 0	17 16 0	
June, 1879	„ ...	Vulcan ...	9 0	21 0 0	
July, „	„ ...	Brisbane...	21 0	17 4 0	

CITY

CITY OF BRISBANE CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
May, 1877	...	Hercules...	25 0	38 16 0	
Mar., 1878	...	Brisbane...	11 10	5 6 0	

CRŒSUS CRUSHINGS.

Jan., 1879	P.C. ...	Hercules...	20 15	32 13 0
Mar., ,,	No. 1 N.	,, ...	43 5	109 0 0
June, ,,	P.C. ...	,, ...	6 0	17 0 0
Oct., ,,	,, ...	,, ...	7 15	18 0 0
Mar., 1880	,, ...	,, ...	22 0	50 4 0
July, ,,	,, ...	,, ...	2 5	4 19 0

DALRYMPLE CRUSHING.

May, 1877	P.C. ...	X.L. ...	25 0	27 10 0

DUCHESS OF DEVONSHIRE CRUSHINGS.

June, 1877	...	Vulcan ...	18 10	14 10 0

DAY SPRING CRUSHINGS.

June, 1877	P.C. ...	Brisbane...	37 0	16 12 12
Feb., 1880	...	,, ...	6 0	8 0 0
April, ,,	P.C. ...	,, ...	34 0	21 0 0

DAN. O'CONNELL CRUSHINGS.

Feb., 1878	P.C. ...	Brisbane...	61 6	47 16 0
April, ,,	,, ...	,, ...	64 4	9 5 0
June, ,,	,, ...	,, ...	8 0	18 0 0
Aug., 1883	...	Vulcan ...	18 16	15 3 0

ECLIPSE CRUSHINGS.

Jan., 1878	P.C. ...	Hercules...	19 10	45 10 0
Feb., 1879	,, ...	,, ...	29 0	52 16 0
Mar., 1880	,, ...	,, ...	14 0	30 18 0
June, ,,	,, ...	,, ...	2 10	1 0 0

ELEANOR CRUSHINGS.

July, 1881	...	Mowbray	52 0	96 12 0
Sep., ,,	P.C. ...	,, ...	53 0	100 0 0
Nov., ,,	...	,, ...	53 0	81 11 0
April, 1882	P.C. ...	,, ...	39 0	33 0 0

EUREKA CRUSHINGS.

Dec., 1877	P.C. ...	Goldfinder	30 0	8 17 0
Mar., 1879	,, ...	Brisbane...	23 10	86 0 0
July, ,,	,, ...	,, ...	66 8	128 0 0
Dec., ,,	,, ...	,, ...	89 0	220 0 0
April, 1880	,, ...	,, ...	148 5	245 0 0
Sep., ,,	...	,, ...	130 0	104 5 0
April, 1881	P.C. ...	,, ...	110 0	190 0 0
May, ,,	...	,, ...	35 0	69 16 0
Feb., 1882	...	,, ...	29 10	19 8 0

FORGET-ME-NOT CRUSHINGS.

June, 1879	P.C. ...	Vulcan ...	31 0	100 0 0
Oct., ,,	No. 1 ...	,, ...	13 0	33 0 0
,, ,,	No. 2 ...	,, ...	7 0	4 10 0
Nov., ,,	...	,, ...	48 6	110 0 0
,, ,,	No. 1 ...	,, ...	13 0	16 0 0
July, 1880	...	,, ...	75 0	350 0 0
Dec., ,,	...	,, ...	39 0	36 13 0
Jan., 1883	...	,, ...	25 10	37 3 0
Aug., ,,	...	,, ...	43 0	149 0 0

FOUR ACRES CRUSHING.

July, 1880	...	Vulcan ...	26 0	13 4 0

FINLAND CRUSHINGS.

Feb., 1877	P.C. ...	Plant and Jackson	25 0	10 0 0	3 7 2
,, 1878	,, ...	Vulcan ...	25 0	17 10 0	
,, 1880	,, ...	,, ...	6 10	13 0 0	

FOUR-LEAVED SHAMROCK CRUSHINGS.

May, 1877	...	Hercules...	31 10	195 5 0
,, ...	...	,, ...	22 10	125 5 0

GREAT BRITAIN CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
Feb., 1877	No. 1 W.	Brisbane...	48 0	59 1 0	3 2 10
,, ,,	No. 2 W.	Welcome...	36 0	35 0 0	3 5 10
Mar., ,,	P.C. ...	Brisbane...	140 0	619 0 0	
,, ,,	,, ...	,, ...	150 0	186 0 0	
July, ,,	,, ...	Vulcan ...	246 0	726 0 0	
May, 1878	,, ...	Brisbane...	480 0	583 0 0	
Aug., ,,	,, ...	Vulcan ...	172 0	256 0 0	
,, ,,	No. 1 NW.	,, ...	84 0	82 0 0	
Mar., 1879	No. 1 W.	,, ...	70 0	90 0 0	
June, ,,	P.C. ...	,, ...	204 0	114 6 0	
Oct., ,,	,, ...	,, ...	8 0	10 0 0	
Jan., 1880	No. 2 ...	,, ...	3 10	2 6 0	
,, ,,	P.C. ...	,, ...	73 0	67 0 0	
Mar., ,,	Surface	,, ...	6 0	2 5 0	
Oct., ,,	...	,, ...	120 0	143 0 0	

GOLCONDA CRUSHING.

Aug., 1877	P.C. ...	Hercules...	3 10	3 0 0

GOOD TEMPLAR CRUSHINGS.

May, 1877	P.C. ...	Hercules...	25 0	67 8 0
Oct., 1879	...	,, ...	9 10	6 13 0

GENERAL GRANT CRUSHINGS.

Feb., 1877	P.C. ...	Welcome...	40 0	160 0 0	3 11 4
Mar., ,,	...	,, ...	21 0	48 0 0	
July, ,,	...	Vulcan ...	59 0	121 0 0	
Aug., ,,	...	,, ...	88 0	95 0 0	
Feb., 1878	...	,, ...	160 9	...	
July, ,,	No. 1 W.	,, ...	31 0	66 10 0	
Nov., ,,	P.C. ...	,, ...	32 0	59 0 0	
Jan., 1879	,, ...	,, ...	64 0	67 0 0	
May, ,,	...	,, ...	19 0	25 0 0	
July, ,,	...	,, ...	15 0	11 0 0	
,, ,,	...	,, ...	6 0	1 5 0	
,, ,,	...	,, ...	310 0	385 0 0	
Oct., ,,	P.P. ...	,, ...	32 0	30 0 0	
,, ,,	P.C. ...	,, ...	21 0	16 0 0	
July, 1880	...	,, ...	7 10	6 0 0	
Oct., ,,	...	,, ...	22 0	16 10 0	
Nov., 1882	...	Pers'ver'nce	14 0	10 4 0	

GULGONG CRUSHINGS.

Mar., 1878	P.C. ...	Goldfinder	6 0	9 9 0
,, ,,	,, ...	,, ...	36 10	40 6 10

HAND-IN-HAND CRUSHINGS.

June, 1878	P. C. ...	X. L. ...	24 0	32 10 0
July ,,	,, ...	,, ...	6 0	9 13 0
Aug. ,,	,, ...	,, ...	18 0	25 0 0
Jan., 1879	,, ...	Goldfinder	8 10	11 15 0
Aug. ,,	...	,,	17 13	24 0 0

HIBERNIA CRUSHINGS.

Aug., 1877	P. C. ...	Vulcan ...	21 0	15 0 0
June, 1879	,, ...	,,	26 0	3 8 0
Aug., 1883	...	,,	18 10	27 6 0

HIGHLAND MARY (AREA) CRUSHING.

July, 1879	...	Goldfinder	4 10	4 0 0

HIDDEN TREASURE CRUSHINGS.

Aug., 1880	...	Hercules...	5 5	8 15 0
Dec. ,,	...	,,	36 0	20 3 0

HIT-OR-MISS CRUSHINGS.

May, 1878	...	Vulcan ...	30 0	60 0 0
June, 1879	P.C. ...	,, ...	33 0	66 0 0
Nov., ,,	...	,, ...	41 0	84 0 0
May, 1880	P.C. ...	Pers'ver'nce	21 11	80 0 0
July, ,,	...	Vulcan ...	18 0	11 10 0
Mar., 1881	P.C. ...	Pers'ver'nce	20 0	34 10 0
May, ,,	...	Brisbane...	9 0	10 5 0

HOPE OF THE NORTH CRUSHINGS.

Mar., 1877	No. 2 ...	Welcome, Kingsboro'	50 0	21 0 0
,, ,,	P.C. ...	,, ...	80 0	152 0 0
April, ,,	,, ...	,, ...	80 0	156 0 0
,, ,,	No. 2 W.	,, ...	50 0	21 10 0
May, ,,	No. 1 ...	Vulcan ...	32 0	54 0 0
April, 1878	...	,, ...	168 0	260 0 0
,, ,,	No. 1 W.	,, ...	139 0	63 13 0

HOPE OF THE NORTH CRUSHINGS—*continued.*

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
May, 1878	No. 2 N.	Vulcan ...	54 0	42 0 0	
,, ,,	No. 1 ...	,, ...	94 0	61 0 0	
Feb., 1879	P.C. ...	,, ...	40 0	40 0 0	
Mar., ,,	,, ...	,, ...	6 10	19 0 0	
Aug., ,,	...	,, ...	63 0	63 10 0	
Dec., ,,	No. 1 ...	,, ...	22 0	14 5 0	
Mar., 1880	...	Pers'ver'nce	131 18	171 9 0	
,, ,,	No. 1 ...	,, ...	27 12	9 10 0	
May, ,,	...	,, ...	34 10	61 10 0	
July, ,,	P.C. ...	,, ...	96 10	66 0 0	
Sep., ,,	...	,, ...	56 0	38 0 0	
April, 1881	P.C. ...	,, ...	40 12	67 2 0	
June ,,	...	,, ...	56 0	40 6 0	
Sep., ,,	...	,, ...	67 0	65 0 0	
June, 1882	...	,, ...	70 0	77 0 0	
Sep., ,,	...	,, ...	70 0	77 5 0	

HOPE-ON CRUSHINGS.

June, 1881	Extended	Hercules...	34 10	142 0 0	
Sep., 1882	...	,, ...	54 0	23 10 0	
May, 1883	Extended	Mowbray	8 0	14 0 0	

HORIZONTAL CRUSHINGS.

Mar., 1878	P.C. ...	Hercules...	62 10	75 0 0	
Dec., 1880	...	,, ...	3 0	2 14 0	

IDA CRUSHING.

May, 1881	...	Hercules...	12 0	6 2 0	

NIL DESPERANDUM CRUSHINGS.

April, 1877	P.C. ...	Welcome...	24 0	151 0 0	
Aug., 1878	,, ...	Vulcan ...	39 0	108 0 0	
Dec., ,,	,, ...	,, ...	6 0	9 10 0	
May, 1879	...	,, ...	15 0	13 0 0	
June, ,,	P.C. ...	,, ...	12 0	6 7 0	

KING OF THE RANGES CRUSHING.

June, 1877	...	Vulcan ...	11 0	2 18 0	

KING OF WESTPHALIA CRUSHINGS.

Aug., 1877	P.C. ...	Hercules...	4 10	9 5 0	
Feb., 1878	...	Goldfinder	21 0	15 18 13	

KENNEDY CRUSHINGS.

Jan., 1878	P.C. ...	Hercules...	25 0	34 0 0	
Sep., ,,	,, ...	,, ...	17 10	13 10 0	

LADY CARLOTTA CRUSHINGS.

Mar., 1877	...	Welcome...	27 0	18 0 0	
May, 1878	...	Vulcan ...	5 0	5 10 0	
Mar., 1880	P.C. ...	Pers'ver'nce	32 15	9 0 0	

LADY HAMBLING CRUSHING.

Nov., 1878	P. C. ...	Brisbane...	7 0	2 10 0	

LAIRD OF THE HILLS CRUSHINGS.

June, 1877	P. C. ...	Vulcan ...	28 0	20 0 0	
,, 1879	,, ...	,, ...	30 0	23 0 0	

LAST CHANCE CRUSHINGS.

June, 1877	P. C. ...	Hercules...	15 0	49 9 0	
Feb., 1878	,, ...	Monarch...	31 0	39 7 0	
Mar., ,,	,, ...	Hercules...	41 0	48 7 0	

LITTLE NELL CRUSHINGS.

Nov., 1877	P. C. ..	Hercules...	16 0	39 5 0	
Apr., 1878	...	X. L. ...	27 0	26 10 0	
July, ,,	P. C. ...	,, ...	3 0	1 14 0	
,, ,,	,, ...	Goldfinder	42 0	27 13 0	
Aug., ,,	,, ...	,,	3 0	3 18 0	
Apr., 1879	,, ...	,,	7 10	9 0 0	
July, ,,	,, ...	,,	9 0	5 10 0	
Mar., 1880	...	Glen Mowbray	12 0	12 0 0	

LISSA CRUSHINGS.

June, 1877	P.C. ...	Hercules...	35 0	40 3 0	
,, ,,	,, ...	,, ...	58 0	58 14 0	
Jan., 1878	,, ...	,, ...	62 0	89 6 0	
June, ,,	,, ...	,, ...	13 10	27 10 0	
Feb., 1879	,, ...	,, ...	62 0	89 6 0	

LADY MAUD CRUSHING.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
July, 1877	P.C. ...	Hercules...	12 0	44 0 0	

LADY MARGUERITE CRUSHING.

Feb., 1878	...	Vulcan ...	35 0	24 0 0	

LEVIATHAN CRUSHINGS.

Mar., 1878	P.C. ...	Goldfinder	59 0	18 17 0	
April, ,,	No. 1 ...	,, ...	3 0	1 3 0	

LIVINGSTONE CRUSHING.

May, 1878	...	Vulcan ...	6 0	6 10 0	

LONE STAR CRUSHINGS.

Mar., 1878	P.C. ...	Goldfinder	25 0	11 0 0	
Apr., ,,	,, ...	,,	42 0	9 6 0	

MARY CRUSHINGS.

Feb., 1877	P.C. ...	Hercules...	20 0	63 0 0	2 13 6
,, 1878	,, ...	,, ...	39 0	52 16 0	
June, ,,	,, ...	,, ...	14 10	15 0 0	
Sept., ,,	,, ...	,, ...	8 0	16 10 0	

MAITLAND CRUSHINGS.

Feb., 1877	P.C. ...	Brisbane...	22 0	17 8 0	3 7 4
,, 1878	,, ...	,, ...	7 14	6 4 0	
May, 1881	,, ...	,, ...	13 0	16 19 0	

MARSEILLAISE CRUSHINGS.

June, 1877	P.C. ...	X.L. ...	18 4	22 0 0	
April, 1878	...	,, ...	19 10	38 7 12	
June, ,,	...	,, ...	8 0	7 0 0	

MACMAHON CRUSHING.

June, 1877	P.C. ...	Vulcan ...	28 0	17 10 0	

MAID OF AUSTRALIA CRUSHINGS.

May, 1878	...	Vulcan ...	24 0	49 0 0	
Aug., 1881	...	Pers'ver'nce	11 0	24 5 0	

MISTAKE CRUSHINGS.

Aug., 1880	...	Pers'ver'nce	14 0	19 12 0	
Nov., ,,	P.C. ...	,, ...	9 0	22 16 0	

MORGAN'S FOLLY CRUSHING.

Jan., 1878	...	Goldfinder	10 0	3 10 0	

MORNING STAR CRUSHING.

July, 1877	...	Hercules...	10 0	7 8 0	

MOUNT PLEASANT CRUSHINGS.

Jan., 1877	P.C. ...	X.L. ...	17 0	32 8 0	3 11 7
May, ,,	...	,, ...	40 0	16 17 0	
May, 1878	...	,, ...	27 6	22 15 0	
July, ,,	...	,, ...	13 0	18 0 0	
,, ,,	P.C. ...	,, ...	17 0	6 10 0	
Jan., 1880	,, ...	Glen Mowbray	22 0	19 0 0	
Feb., ,,	..	,, ...	5 0	5 0 0	

OLDHAM CRUSHINGS.

May, 1877	P.C. ...	Hercules...	17 0	19 0 0	
June, ,,	,, ...	,, ...	1 10	1 7 0	
April, 1879	,, ...	,, ...	11 10	7 15 0	
Oct., ,,	,, ...	,, ...	1 5	1 4 0	

OTAGO CRUSHINGS.

May, 1877	P.C. ...	Brisbane...	27 8	62 5 0	
Mar., 1878	,, ...	,, ...	7 0	10 0 0	
Oct., ,,	,, ...	,, ...	4 10	7 0 0	

PHILOSOPHER CRUSHINGS.

Mar., 1877	P.C. ...	X.L. ...	37 0	41 0 0	
April, ,,	,, ...	Brisbane...	49 0	24 10 0	
Mar., 1878	,, ...	X.L. ...	66 0	62 9 0	
June, ,,	,, ...	Goldfinder	88 0	40 3 0	
April, 1879	Extended	,, ...	20 10	10 0 0	
June, ,,	P.C. ...	,, ...	48 0	35 10 0	

PERSEVERANCE

PERSEVERANCE CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
April, 1878	P.C.	Vulcan	31 0	46 0 0	
Sep., 1879	...	,,	22 0	46 0 0	
Dec., ,,	...	,,	2 10	2 17 0	
Mar., 1880	P.C.	,,	17 0	15 15 0	
July, ,,	...	,,	30 0	16 0 0	
Sep., ,,	..	,,	19 0	4 0 0	

PHOLA CRUSHINGS.

Jan., 1879	...	Hercules	1 10	4 5 0	
,, ,,	...	,,	4 0	5 15 0	

PARRAMATTA CRUSHING.

Mar., 1879	P.C.	Vulcan	25 0	33 0 0	

QUEEN CRUSHINGS.

Jan., 1878	Queen	Brisbane	12 10	18 6 0	
,, 1879	Queen of Hearts	,,	6 10	9 5 0	
Sep., ,,	Queen P.C.	Glen Mowbray	56 0	18 0 0	
May, 1881	Queen of Hearts	Brisbane	56 0	44 7 0	

RANGER CRUSHINGS.

Mar., 1877	P.C.	Welcome	15 0	46 0 0	
,, 1878	No. 1 W.	Vulcan	12 0	12 0 0	
,, ,,	No. 1 E.	,,	15 0	19 0 0	
Dec., ,,	P.C.	,,	14 0	14 10 0	
May, 1879	,,	,,	16 0	13 0 0	

RAINBOW CRUSHING.

Jan., 1877	P.C.	Hercules	35 0	87 11 0	

RESOLUTE CRUSHINGS.

July, 1877	P.C.	Brisbane	9 0	13 3 0	
Sep., 1879	,,	,,	8 0	15 0 0	

SHAMROCK CRUSHINGS.

Dec., 1877	P.C.	Goldfinder	124 0	218 14 0	
Mar., 1880	,,	Hercules	12 0	13 15 0	

SIR ARTHUR KENNEDY CRUSHINGS.

June, 1878	P.C.	Hercules	27 0	21 7 0	
Mar., 1879	,,	,,	7 15	13 0 0	
Dec., ,,	...	Brisbane	17 10	20 0 0	

ST. GEORGE CRUSHING.

Jan., 1883	...	Brisbane	15 6	7 0 0	

SIR JOHN FRANKLIN CRUSHING.

July, 1877	...	Brisbane	17 0	15 18 12	

SIR WILLIAM WALLACE CRUSHING.

April, 1877	P.C.	Hercules	12 0	7 15 0	

SOUTHERN CROSS CRUSHINGS.

Mar., 1877	P.C.	Hercules	14 0	7 0 0	
Feb., 1878	,,	Brisbane	13 12	39 5 0	
July ,,	,,	X.L.	6 0	3 0 0	
,, ,,	,,	,,	5 0	2 14 0	
Aug., ,,	,,	,,	46 0	39 3 0	

STAR OF THE SOUTH CRUSHINGS.

July, 1877	P.C.	Brisbane	32 9	61 16 12	
,, ,,	No. 2	,,	8 8	8 7 0	
Mar., 1878	P.C.	Vulcan	26 0	181 0 0	
Nov., ,,	,,	,,	59 0	328 0 0	
May, 1879	,,	,,	31 0	105 0 0	
Nov., ,,	...	,,	18 0	37 15 0	
Mar., 1880	...	,,	5 0	4 10 0	

SUNBEAM CRUSHINGS.

Nov., 1877	...	Brisbane	4 10	8 18 12	
Jan., 1878	P.C.	,,	6 0	6 15 0	
Mar., ,,	,,	,,	14 0	39 0 0	
Jan., 1879	...	,,	39 15	90 18 0	

SUNSET CRUSHING.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
Mar., 1878	P.C.	X.L.	5 0	8 19 0	

TENISON WOODS CRUSHING.

Oct., 1880	...	Vulcan	48 0	24 0 0	

THREE STAR CRUSHINGS.

April, 1877	P.C.	Hercules	38 0	37 6 0	
Mar., 1878	,,	Brisbane	11 10	18 13 4	
June, ,,	...	,,	9 0	4 0 0	

TRIUMPH CRUSHINGS.

July, 1879	P.C.	Brisbane	50 0	59 14 0	
Dec., ,,	Extended	,,	65 0	81 0 0	
April, 1881	...	Mowbray	6 10	30 0 0	

UNITED CORNISH CRUSHING.

Feb., 1878	...	Goldfinder	70 0	57 6 0	

VAGABOND CRUSHING.

May, 1878	...	Vulcan	6 0	7 13 0	

VESTAL CRUSHING.

Dec., 1877	...	Goldfinder	30 0	12 12 12	

VICTORIA CRUSHINGS.

Dec., 1877	P.C.	Goldfinder	57 0	54 12 12	
June, 1878	,,	Hercules	23 10	59 0 0	
,, 1879	,,	,,	218 0	156 0 0	
July, ,,	,,	Goldfinder	4 10	12 0 0	
Aug., ,,	,,	,,	12 10	30 5 0	
Sep., ,,	,,	Hercules	15 0	19 10 0	
May, 1881	...	,,	2 0	2 8 0	
Feb., 1883	...	Brisbane	44 7	20 12 0	

VIEW OF THE HILLS CRUSHING.

Oct., 1880	...	Vulcan	33 0	12 0 0	

WATERVIEW CRUSHING.

Aug., 1877	...	Hercules	9 10	11 0 0	

WAVERLEY CRUSHINGS.

Mar., 1877	P.C.	Welcome	31 0	68 0 0	
April, 1878	,,	Vulcan	30 0	36 0 0	
June, ,,	...	,,	19 10	24 0 0	
Aug., ,,	P.C.	,,	20 0	19 0 0	
Sep., 1879	...	,,	11 0	11 5 0	

WELCOME CRUSHINGS.

May, 1877	P.C.	Vulcan	21 0	105 7 0	
Feb., 1878	,,	,,	34 0	57 0 0	
July, ,,	,,	,,	13 0	36 0 0	
Jan., 1880	...	,,	11 0	13 15 0	

WAIT-A-WHILE CRUSHINGS.

July, 1879	..	Vulcan	27 0	31 0 0	
Oct., ,,	P.C.	,,	8 0	15 0 0	
,, ,,	No. 1	,,	12 0	8 15 0	
Mar., 1880	P.C.	Pers'ver'nce	64 14	32 15 0	
,, ,,	,,	,,	12 0	10 0 0	
May, ,,	..	,,	15 15	10 15 0	
June, ,,	P.C.	,,	13 0	5 6 0	
April, 1881	,,	,,	7 18	2 5 0	

WILCANNIA CRUSHING.

July, 1877	P.C.	Hercules	18 0	11 18 0	

WILTSHIRE CRUSHINGS.

June, 1877	P.C.	Brisbane	7 0	21 2 0	
July ,,	,,	,,	7 0	21 9 0	
Feb., 1878	,,	,,	3 16	10 14 0	

YOUNG AUSTRALIA CRUSHINGS.

June, 1877	...	Brisbane	46 0	26 15 0	
May, 1878	P.C.	,,	4 0	3 12 0	
Sep., 1879	,,	,,	21 0	3 0 0	

DOWN

DOWN THE RIVER.

MACROSSAN TOWER, DEEP CREEK.

MACROSSAN TOWER CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
Mar., 1878	P.C. ...	Magnet ...	5 0	3 11 0	
April, „	„ ...	Goldfinder	27 0	54 13 0	
„ „	No. 1 ...	„ ...	9 0	1 3 0	
Mar., 1879	P.C. ...	Magnet ...	32 0	34 18 0	

Strike, north-north-west; underlie, west-south-west.

VICTORIA, DEEP CREEK, CRUSHINGS.

Jan., 1877	P.C. ...	Magnet ...	16 0	33 5 0	3 17 0
June, „	...	„ ...	26 0	72 18 0	
July, „	P.C. ...	„ ...	138 0	61 7 12	
July, 1878	„ ...	„ ...	36 0	40 5 0	
May, 1880	...	„ ...	8 10	16 19 12	

Strike, north-north-west; underlie, west-south-west.

QUEENSLANDER CRUSHINGS.

Mar., 1877	No. 1 ...	Magnet ...	42 0	54 18 0	
Feb., 1878	...	Goldfinder	88 0	118 0 0	

QUEENSLANDER CRUSHINGS—*continued.*

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
Feb., 1878	No. 1 N.	Magnet ...	52 0	40 9 0	
„ „	„	„ ...	29 0	185 18 0	
Mar., „	„	„ ...	51 0	52 2 0	
„ „	...	„ ...	30 0	185 18 0	
July, „	No. 1 N.	„ ...	43 0	142 17 0	
Feb., 1879	P.C. ...	„ ...	89 0	189 1 0	
Mar., „	„ ...	„ ...	89 0	198 1 0	
June, „	No. 1 ...	„ ...	58 0	109 5 0	
„ „	P.C. ...	„ ...	36 0	49 18 0	
Dec., „	„ ...	„ ...	34 0	29 17 0	
Mar., 1880	No. 1 ...	„ ...	41 0	90 0 0	
June, „	No. 1 N.	„ ...	12 10	10 5 0	
„ „	P.C. ...	„ ...	7 0	12 0 0	
July, 1881	...	Lodestone	20 0	31 14 0	
Mar., 1883	...	Home Rule	43 19	47 5 0	

QUEENSTOWN CRUSHING.

Dec., 1877	...	Goldfinder	50 0	149 15 0	

DAGWORTH, WOODVILLE.

A little work was being done here when I visited the place in December last, but there had been no crushings since 1879. Nothing was visible by which we could judge of the importance of the reef.

DAGWORTH CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
May, 1877	P.C. ...	Magnet ...	8 0	28 8 0	
„ „	No. 1 E.	„ ...	6 0	6 8 0	
„ 1878	P.C. ...	„ ...	52 0	63 0 0	
July, „	„ ...	„ ...	21 0	29 14 0	

CAPTAIN COOK.

The main working is an underlie shaft 110 feet deep. At the depth of 70 feet there was a blank, but immediately below it there was some good stone. About 12 tons stacked from this place showed a good deal of gold. Above the present bottom level there was another blank. At the bottom the reef is about 6 feet thick, but the quartz is not more than 3 inches. About 12 feet to the east there are about 9 inches of vein in all, with some arsenical pyrites in the quartz. About 60 tons stacked from the bottom show gold pretty freely.

CAPTAIN COOK CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
May, 1877	P.C. ...	Magnet ...	31 0	37 0 0	
Sep., „	„ ...	„ ...	50 0	48 13 0	
June, 1878	„ ...	„ ...	16 0	20 0 0	
Nov., „	Lease ...	„ ...	25 0	103 2 0	
Mar., 1879	„ ...	„ ...	40 0	105 13 0	
May, „	„ ...	„ ...	23 0	37 5 0	
June, „	„ ...	„ ...	49 0	34 0 0	
Mar., 1880	...	„ ...	95 0	91 0 0	
May, „	...	„ ...	7 0	4 15 0	

CAPTAIN COOK CRUSHINGS—*continued.*

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
June, 1881	...	Lodestone	38 0	58 10 0	
Sep., 1882	...	Home Rule	82 0	144 14 0	
Nov., „	...	„ ...	82 0	114 7 0	
Dec., „	...	„ ...	59 0	53 0 0	

CROWN CRUSHINGS.

June, 1877	P.C. ...	Lodestone	38 0	38 0 0	3 13 8
Mar., 1878	„ ...	Magnet ...	41 0	25 4 0	

ST. GEORGE CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
Feb., 1877	P.C. ...	Magnet ...	40 0	213 16 0	3 16 9
„ „	No. 1 ...	„ ...	22 0	18 0 0	3 16 9
„ „	No. 2 ...	„ ...	12 0	16 4 0	
June, „	P.C. ...	„ ...	140 0	780 0 0	
Oct., „	„ ...	„ ...	82 0	390 0 0	
May, 1878	„ ...	„ ...	34 0	62 16 0	
July, „	No. 2 W.	„ ...	21 0	129 16 0	
Mar., 1879	No. 2 W.	„ ...	17 0	60 0 0	

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
April, 1879	P.C. ...	Magnet ...	6 0	6 0 0	
Dec., „	„ ...	„ ...	27 0	29 13 0	
„ „	No. 2 ...	„ ...	6 0	11 12 0	
Jan., 1880	P.C. ...	„ ...	8 0	22 0 0	
May, „	...	„ ...	7 0	60 10 0	
June, „	Extended	„ ...	4 0	3 10 0	
Sep., „	...	Lodestone	4 0	15 8 0	
Oct., 1881	...	„ ...	9 0	35 3 0	

HOME RULE (*Diagram* 13).

The Home Rule is worked by a limited liability company, Mr. James Crosbie, manager. The "Brisbane" Machine has been purchased by the company, and erected on the river beside the works. All above the dotted line on the plan was worked before the company took possession in April, 1882. The water level is 100 feet; but the water is trifling in quantity.

The reef crops out on an easy ridge beside the township of Woodville (till recently called Watsonville). Its strike is west 10 degrees north, and east 10 degrees south, and its underlie to south 10 degrees west at 70 degrees.

West of No. 4 shaft the quartz was 3 to 9 feet thick. Between shafts 3 and 4, and nearer No. 4, at the 75-feet level, a large reef is seen divided by much black slate formation or gangue. Near No. 3 shaft the reef is 14 feet thick, including much "formation."

Near the bottom of No. 3 shaft a one-foot vein of quartz occurs on the hanging-wall, but it has little gold in it. The next seven feet lower consist of dark fragmentary gangue of greywacke and slate reticulated with quartz veins. A smooth vertical wall at the bottom was left by the former owners as a hanging-wall. Mr. Crosbie drove across it and found the true hanging-wall. The drive showed, in ascending order—(1) black gangue, (2) a 2-inch vein of quartz with visible gold in every stone, and (3) 2 feet of black gangue. Three feet upwards the 2-inch vein of quartz thickened to 5 inches.

At the bottom of the worked ground west of No. 2 shaft, the footwall and hanging-wall come together, and the stone becomes poor. The same thing happened east of the shaft. There the reef contained large blocks of sulphide of antimony. At the same level, between No. 2 and No. 1 shafts, the reef narrows to 2½ feet. About 10 feet from No. 1 shaft, a slip comes from the hanging-wall and on to the footwall, and the underlie of the reef is reversed. The stone is all on the footwall (now the hanging-wall). Bitumen exudes in small quantities from the hanging-wall a little further west.

At the bottom of No. 2 shaft Mr. Crosbie drove through the hanging-wall, and in 10 feet struck a 2-feet vein of quartz, which, however, was poor in gold.

In No. 1 shaft, from the 90-feet level downward, there was little quartz and very little gold. At the bottom of the shaft a smooth hanging-wall has been followed for 25 feet to the west, but it seemed to me that the body of the reef was rather to be looked for in the direction of the footwall.

The present working is mainly in a stope east of No. 4 shaft at the 165-feet level. For some distance above, the shaft had neither quartz nor gold. The face of the stope showed 2 feet of good stone, in which gold was occasionally visible. The whole reef is here 9 feet thick. At the bottom of this stope another "break" occurs, as a slip comes in from the hanging-wall side and "dips" to the footwall, cutting out the stone.

Mr. Crosbie gives it as his experience in this mine that no definite "shoots" of rich stone can be traced in any direction. The stone is sometimes richer and sometimes poorer in places, but he can recognise no rule which is not merely fanciful.

The cap of an antimony lode is seen to the south of No. 4 shaft, and can be traced for some distance towards the boarding-house. It runs north-west and south-east.

HOME RULE CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
Feb., 1877	P.C. ...	Magnet ...	102 0	240 10 0	3 16 1
May, "	" ...	" ...	95 0	225 0 0	
Sep., "	" ...	" ...	117 0	500 0 0	
" "	No. 1 E.	" ...	30 0	33 18 0	
Oct., "	No. 1 N.	" ...	16 0	18 14 0	
Nov., "	P.C. ...	" ...	90 0	181 11 0	
Feb., 1878	No. 1 W.	" ...	28 0	26 7 0	
May, "	P.C. ...	" ...	110 0	349 0 0	
Dec., "	No. 3 W.	" ...	38 0	15 10 0	
June, 1879	Lease No. 3	" ...	150 0	298 10 0	
Mar., 1880	Lease ...	" ...	300 0	258 0 0	
June, "	Extended	" ...	8 10	21 17 0	
Sep., "	...	Lodestone	13 0	47 0 0	
April, 1881	...	" ...	70 0	100 18 0	
June, "	...	" ...	146 0	169 0 0	
Oct., "	...	" ...	not giv'n	27 0 0	
" "	...	" ...	72 0	34 17 0	
Sep., 1882	...	Home Rule	57 0	91 8 0	
Oct., "	...	" ...	241 0	190 5 0	
" "	...	" ...	240 0	65 13 0	
" "	Surface	" ...	3 0	3 0 0	
Oct., 1883	Lease ...	" ...	52 10	41 0 0	

WILLIAM TELL CRUSHINGS.

Feb., 1877	P.C. ...	Magnet ...	97 0	167 18 0	3 16 8
Sep., "	" ...	" ...	113 0	110 12 0	
May, 1878	...	" ...	100 0	39 2 0	
Nov., 1882	P.C. ...	Home Rule	241 0	190 5 0	
Dec., "	...	" ...	7 16	53 0 0	

UNDER THE BINNACLE CRUSHINGS.

Mar., 1877	P.C. ...	Magnet ...	20 0	49 15 0
Dec., 1879	" ...	...	20 0	15 0 0

WORKING MINER CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
Mar., 1877	P.C. ...	Magnet ...	55 0	85 0 0	
May, "	No. 1 E.	" ...	17 0	11 7 0	
Feb., 1878	P.C. ...	" ...	150 0	131 0 0	
Mar., "	" ...	" ...	46 0	29 0 0	
June, "	No. 1 E.	" ...	38 0	23 11 0	
July, "	P.C. ...	" ...	96 0	81 10 0	
April, 1879	" ...	" ...	130 0	141 0 0	
Jan., 1880	...	" ...	123 0	99 17 0	
May, "	...	" ...	57 0	29 15 0	

LIGHTHOUSE CRUSHINGS.

May, 1877	P.C. ...	Magnet ...	25 0	18 1 0
June, 1878	" ...	" ...	172 0	284 2 0
Dec., "	" ...	" ...	90 0	80 1 0
May, 1879	Lease ...	" ...	70 0	40 0 0
Dec., "	...	" ...	75 0	33 3 0

ROSE AND SHAMROCK CRUSHINGS.

Mar., 18[illegible]	P.C. ...	Magnet ...	19 0	18 18 0

RESULT CRUSHINGS.

May, 1877	P.C. ...	Lodestone	20 0	14 15 0
Mar., 1878	" ...	" ...	56 0	58 19 0
April, "	...	" ...	50 0	32 15 0
Aug., "	...	" ...	38 0	60 1 0
Sep., "	P.C. ...	" ...	20 0	11 15 0
Oct., "	Surface stone	" ...	30 0	9 9 0

RED JACKET CRUSHINGS.

May, 1877	P.C. ...	Lodestone	13 0	12 17 0	3 14 9
Sep., "	" ...	" ...	12 0	10 19 0	

MOUNT

MOUNT BLAKE CRUSHINGS.

	Part of Reef.	Machine.	Quartz Crushed	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
Sep., 1877	P.C.	Lodestone	9 0	23 5 0	3 14 10
April, 1878		,,	35 0	93 16 0	
Oct., 1879		,, ...	32 0	33 6 0	

CHANCE CRUSHINGS.

July, 1877	..	Lodestone	54 0	42 16 0	2 13 0
Sep., ,,	P.C. ...	,, ...	6 0	5 5 12	3 9 7
,, ,,	.. ...	,, ...	23 0	13 18 12	3 13 0
June, 1878	No. 1 E.	,, ...	20 0	10 15 0	
Sep., ,,	P.C. ...	,, ...	60 0	38 1 0	
Aug., 1879	,, ...	,, ...	14 0	40 0 0	
Dec., ,,	...	,, ...	50 0	33 11 0	
April, 1880	.	,, ...	14 0	5 5 0	
Sep., ,,	...	,, ...	12 0	18 0 0	

BAND OF FREEDOM CRUSHINGS.

May, 1877	P.C. ...	Lodestone (St'w'rtst'n)	60 0	93 17 0	
Sep., ,,	...	,, ...	24 0	27 7 6	
June, 1881	...	,, ...	72 0	34 7 0	
July, ,,	...	,, ...	72 0	37 2 0	

RICHMOND CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
Feb., 1877	P.C. ...	Magnet ...	41 0	36 12 0	3 19 1
May, ,,	No. 1 E.	,, ...	18 0	22 13 12	
Feb., 1878	No. 1 W.	,, ...	50 0	20 14 0	
May, ,,	P.C. ...	Lodestone	11 0	19 2 0	

GERALDINE CRUSHINGS.

June, 1877	P.C. ...	Lodestone	44 0	82 8 0	3 17 4
Sep., ,,	,, ...	,, ...	63 0	85 14 0	3 16 9
Mar., 1878	,, ...	,, ...	59 0	68 0 0	
June, ,,	No. 1 ...	,, ...	25 0	12 1 0	
July, ,,	P.C. ...	,, ...	188 0	86 3 0	
Aug., ,,	,, ...	,, ...	116 0	63 15 12	
Mar., 1879	Lease ...	,, ...	185 0	133 19 0	
Aug., ,,	P.C. ...	,, ...	112 0	45 10 0	
April, 1880	...	,, ...	59 0	35 4 0	
May, 1882	P.C. ...	The Union	223 0	162 13 0	

UNION. (*Diagram* 14.)

The Union is at present the most important mine on the field. It employs twenty-one men under ground, besides the hands engaged in haulage, wood-cutting, at the machine, &c. It is worked by a limited liability company, under the management of Mr. Burns. I visited the mine in December last.

In the east corner of the vertical shaft at the 200-feet level 18 inches of quartz are seen on the hanging-wall. The total thickness of quartz and gangue at this place is 4½ feet. Along the level the quartz averages 18 inches, although in one place it pinches to 6 inches. Midway between the vertical and the main shaft the "formation" for a space contains no quartz at all.

In the stope west of the main shaft and between the 200 and 270-feet levels there are from 9 inches to 3 feet of quartz seen on the face. Generally the lower portion, about eight or nine inches thick, of the quartz adjoining the footwall has a good deal of iron pyrites and yields better than the rest. The whole of the quartz, however, is crushed.

Near the winze, below the 270-feet level, the reef has been quite ten feet thick. In the winze, however, a break or slip is seen, which throws the hanging-wall down against the footwall. Here there were about 2 feet of stone with some visible gold. Six feet down the winze the stone on the left side was very poor. In six feet more, however, it improved greatly and gave much better promise. After a few feet more, where there is little quartz, a vein rises from the footwall and joins the hanging-wall vein, making three feet in all. At the bottom of the winze there are 2½ feet of good stone on the hanging-wall.

To the east of the main shaft the "break" is seen all the way. It is nearly vertical, with a small quartz vein in one place. At the end, and about 30 feet down, the stone bulges, and may average 2 feet thick to the north of the break. On the east face of the stope between the 200 and 270 feet level, about 1 foot of quartz is seen on an average, perhaps one-third of which promises well. West of the vertical shaft the "break" is again seen at the 200-feet level. It appears to affect the hanging-wall only.

The underlie of the reef is about 45 degrees in the upper level, but not so great in the lower. The water level stands at about 300 feet (measured down the underlie).

As seen in the tunnel the greywackes and shales strike north-west and south-east.

UNION CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
July, 1877	No. 1 ..	Lodestone	122 0	249 0 0	3 18 6
,, ,,	P.C. ...	,, ...	171 0	305 0 0	3 19 0
,, ,,	No. 3 ...	,, ...	29 0	12 11 0	3 17 0
May, 1878	No. 1 E.	,, ...	144 0	291 5 0	
,, ,,	P.C. ...	,, ...	216 0	302 17 0	
,, ,,	No. 1 NW.	,, ...	12 10	2 15 0	
Oct., ,,	P.C. ...	,, ...	158 0	215 10 0	
May, 1879	United...	,, ...	741 0	1155 18 0	
June, ,,	No. 2 ...	,, ...	23 0	14 8 0	
Dec., ,,	...	,, ...	805 0	885 14 0	
June, 1880	United...	,, ...	867 0	919 0 0	
Nov., ,,	...	Magnet ...	200 0	207 10 0	
Dec., ,,	...	,, ...	200 0	242 18 0	
Jan., 1881	...	,, ...	200 0	220 0 0	
April, ,,	...	,, ...	130 0	151 12 0	
May, ,,		,, ...	190 0	236 7 0	
June ,,	...	,, ...	230 0	274 17 0	

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
July, 1881	...	Magnet ...	280 0	380 0 0	
Aug., ,,	Lease ...	,, ...	240 0	488 15 0	
,, ,,	No. 1 ...	,, ...	140 0	170 5 0	
Sep., ,,	Lease ...	,, ...	240 0	426 12 0	
Oct., ,,	...	,, ...	290 0	363 0 0	
Feb., 1882	...	Union ...	410 0	597 0 0	
April, ,,	...	,, ...	295 0	399 10 0	
May, ,,	...	,, ...	280 0	278 0 0	
July, ,,	...	,, ...	400 0	491 5 0	
Sep., ,,	...	,, ...	120 0	150 10 0	
Nov., ,,	Lease ...	,, ...	390 0	594 15 0	
May, 1883	,, ...	,, ...	275 0	209 0 0	
June, ,,	,, ...	,, ...	270 0	230 0 0	
July, ,,	,, ...	,, ...	268 0	240 14 0	
Aug., ,,	,, ...	,, ...	256 0	203 3 12	
Oct., ,,	,, ...	,, ...	518 0	473 15 0	

INFANT

INFANT CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
June, 1877	P.C. ...	Lodestone	11 0	21 3 0	3 18 0
" "	" ...	"	16 0	10 6 12	3 16 4

SIR JOHN ROBERTSON CRUSHINGS.

Mar., 1878	P.C. ...	Goldfinder	27 10	8 18 0	

ST. PATRICK CRUSHINGS.

Mar., 1878	P.C. ...	Lodestone	85 0	64 0 0	
April, "	No. 1 S.	" ...	20 10	20 9 0	
June, "	...	" ...	21 0	20 12 0	
" 1879	P.C. ...	" ...	31 0	22 13 0	
Aug., "	" ...	" ...	33 0	10 0 0	

WELLESLEY CRUSHINGS.

June, 1877	P.C. ...	Lodestone	12 0	29 19 0	3 16 6
July, "		" ...	11 0	28 8 12	
June, 1878		" ...	6 0	1 17 0	
" "		" ...	4 10	4 14 0	

BEN JOY CRUSHINGS.

Feb., 1877	P.A ...	Magnet ..	5 0	9 15 0	3 17 6
Mar., "	P.C. ...	" ...	5 0	10 5 0	
May, "	" ...	" ...	9 0	10 7 0	
June, "	" ...	" ...	9 0	10 6 0	
Oct., "	" ...	" ...	13 0	21 17 0	
Feb., 1878	" ..	" ...	8 0	26 10 0	

BLACK TULIP CRUSHINGS.

Mar., 1877	P.C. ...	Magnet ...	23 0	32 14 0	
June, "	" ...	" ...	27 0	69 10 0	
Feb., 1878	" ...	Goldfinder	47 0	94 0 0	
July, "	" ...	Magnet ...	30 0	31 10 0	
Feb., 1879	" ...	...	89 0	189 1 0	

MAID OF THE FOREST CRUSHINGS.

April, 1878	...	Lodestone	58 10	38 13 0	
Aug., 1879	...	...	16 0	4 0 0	
April, 1880	...	" ...	14 0	7 5 0	

MOUNT LILLY CRUSHINGS.

May, 1878	...	Lodestone	20 10	17 1 0	

CATHERINE CRUSHINGS.

Jan., 1877	P.C. ...	Magnet ...	7 0	14 13 0	3 16 8

CHALLENGE CRUSHINGS.

May, 1878	...	Loadstone	22 10	8 18 0	

EDINBURGH CASTLE CRUSHINGS.

Sep., 1877	P.C. ...	Magnet ...	9 0	20 2 0	
Oct., "	...	" ...	8 0	24 0 0	
Nov. 1882	...	Home Rule	25 0	26 10 0	

EXCHANGE CRUSHINGS.

May, 1877	P.C. ...	Loadstone	20 0	11 15 0	
June, 1878	...	" ...	27 0	11 16 0	

FREE-TRADER CRUSHINGS.

May, 1877	P.C. ...	Loadstone	20 0	15 18 0	
Sep., 1878	"	" ...	30 0	10 8 0	

FLYING-JIB CRUSHINGS.

June, 1877	P.C. ..	Lodestone	24 0	12 10 0	3 13 0

GREAT WESTERN CRUSHINGS.

April, 1878	...	Lodestone	10 10	11 15 0	

HOMEWARD BOUND CRUSHINGS.

July, 1877	...	Magnet ...	46 0	27 6 11	
June, 1878	P.C. ..	" ...	25 0	15 5 0	

HIT-OR-MISS CRUSHINGS.

June, 1877	P.C. ...	Lodestone	20 0	29 13 0	3 17 1
Mar., 1878	" ...	" ...	80 0	72 0 0	
June, "	...	" ...	23 0	16 6 0	

JOLLY TAR CRUSHINGS.

......	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
April, 1877	P.C. ...	Alexander, Deep Creek	42 0	71 0 0	
Dec., "	" ...	Goldfinder	71 0	88 9 0	

LADY EMMELINE CRUSHINGS.

June, 1877	P.C. ...	Magnet ...	20 0	12 14 0	

LADY EMILY CRUSHINGS.

June, 1877	P.C. ...	Lodestone	2 10	3 12 0	

LADY FRANCES CRUSHINGS.

April, 1878	...	Lodestone	60 0	67 8 0	

LITTLE WONDER CRUSHINGS.

April, 1877	...	Lodestone	26 0	26 17 0	
June, 1878		" ...	15 10	21 8 0	

MAIN STAY CRUSHINGS.

May, 1877	P.C. ...	Lodestone	93 0	100 2 0	
July, 1878	" ...	" ...	28 0	12 15 0	

MOUNTAIN CRUSHINGS.

Jan., 1877	P.C. ..	Magnet ..	31 0	16 12 0	3 15 10

MOUNT TRIAL CRUSHINGS.

Dec., 1879	...	Lodestone	8 0	4 4 0	
April, 1880	...	" ...	25 10	6 17 0	

NEVER-TOO-LATE-TO-MEND CRUSHINGS.

Mar., 1878	P.C. ...	Lodestone	14 0	3 11 0	
April "	...	" ...	46 0	25 4 0	
Sep., "	P.C. ..	" ...	3 0	3 11 0	

NORTH STAR CRUSHINGS.

June, 1877	P.C. ...	Lodestone	51 0	43 16 0	3 17 0
June, 1878	...	" ...	22 0	5 18 0	
" "	...	" ...	65 0	56 13 0	
June, 1879	P.C. ...	" ...	45 0	14 5 0	

OLD JACK CRUSHINGS.

June, 1877	P.C. ...	Lodestone	3 10	3 5 0	3 4 6

PERSEVERANCE CRUSHINGS.

May, 1877	P.C. ...	Lodestone	55 10	103 0 0	
June, "	" ...	" ...	11 0	17 5 11	3 11 11
Sep., "	" ...	" ...	30 0	37 1 0	3 11 7
June, 1878	...	" ...	28 0	16 8 0	
Aug., "	P.C. ...	" ...	2 0	3 0 0	
Sep., "	" ...	" ...	111 0	39 13 0	
" 1880	..	" ...	105 0	41 5 0	
April, 1881	...	" ...	140 0	81 19 0	

ROYAL SOVEREIGN CRUSHINGS.

Feb., 1878	...	Goldfinder	51 0	63 5 0	

ROBIN HOOD CRUSHINGS.

May, 1878	...	Lodestone	75 0	64 6 0	
" 1881	...	" ...	236 0	165 8 0	

SPRING GULLY CRUSHINGS.

May, 1877	P.C. ...	Loadstone	53 0	105 0 0	3 16 0
Sep., "	"	Spring Gully	20 0	80 0 0	
Feb., 1878	"	" ...	80 0	88 0 0	
Mar., "	"	" ...	160 0	120 0 0	
April, "	...	" ...	200 0	100 0 0	

ST. PAUL'S CRUSHINGS.

Aug., 1878	P.C. ...	Goldfinder	2 0	3 3 0	
" "	"	" ...	18 0	6 15 0	
Jan., 1879	"	" ...	7 0	8 15 0	

STAR OF HOPE CRUSHINGS.

May, 1877	P.C. ...	Magnet ...	18 0	44 9 0	
Feb., 1878	" ...	" ...	19 0	30 14 0	

STRANGER

STRANGER CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
Nov., 1877	P.C. ...	Magnet ...	3 0	9 0 0	

TRY AGAIN CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
Jan., 1877	P.C. ...	X. L. ...	11 0	24 5 0	3 11 6
May, 1878	...	Vulcan ...	6 0	7 15 0	
Mar., 1879	P.C. ...	Magnet ...	42 0	32 11 0	
July, "	P.C. ...	Goldfinder	9 0	8 0 0	

TRY AGAIN CRUSHINGS—*continued.*

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
Jan., 1880	P.C. ...	Magnet ...	45 0	36 8 0	
Aug., "	...	Mowbray	4 0	4 15 0	

TOKATEA CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
Feb., 1878	...	Goldfinder	19 0	9 4 12	

UNION JACK CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
June, 1878	...	Lodestone	32 0	22 5 0	
Aug., "	P.C. ...	"	20 0	8 17 6	

NIL DESPERANDUM ANTIMONY LEASE.

This mine occurs on the right bank of the Hodgkinson, about a mile south of the Home Rule. The course of the lode is west-north-west, and the underlie to south-south-west at 70 degrees.

The lode has not been much opened. From one hole eight feet deep about 12 tons of ore have been taken. A 9-inch vein of very pure stibnite is seen going down to the bottom of the hole. One block on the surface is quite pure ore, nd 15 inches thick. A vertical shaft has been sunk 20 feet, but has not yet bottomed. A second small hole has been sunk about 50 feet east of the first, and some ore has been taken out.

Several other parallel lodes of antimony ore are seen to the north, and can be traced for a considerable distance.

EASTERN HODGKINSON (McLEODSVILLE.)

B. B. REEF.

The strike of the reef is north-north-west to south-south-east, and its underlie east-north-east at 45 degrees. The country is black gnarled shale or schist and greywacke. The quartz paddocked (say 25 tons) is partly crystalline and partly flaggy, with red and yellow stained cavities, from which pyrites, crystals, and masses of hematite have weathered out.

On descending the main shaft I found the quartz rather thin for the first 40 feet. There was a good hanging-wall. At 40 feet a body of quartz was followed for ten feet to the north-north-west. At the 140-feet level the stone continued to 60 feet north-north-west of the shaft. The stone was stoped out from the shaft to the ends of the 40-feet and 140-feet levels. I was informed that at 100 feet on the underlie the quartz was 3½ feet thick; at 140 feet, 2 feet; at 170 feet, 15 to 20 inches. At 185 feet it had thinned out altogether. At the 200-feet (bottom) level quartz had again appeared. The average thickness of gangue was three feet. At the 100-feet level is a drive to the south-south-east 20 feet long on good stone. A triangular stope was taken out here, bounded by the level, the shaft and a line connecting the end of the level with the shaft at a point 25 feet below the level.

The water level is at 150 feet (on the underlie). I was informed by the owners that it takes two or three hours daily to bale the water with a windlass. They were erecting a whip.

The "Victory" machine (6 head of stamps) was established on McLeod's Creek about a quarter of a mile from the B.B. The situation was convenient, not only to the B.B., but to a large group of reefs. But the owners of the machine were also owners of several reefs which had an output sufficient to keep the machine going. They are said to have charged the outside public a prohibitive rate for crushing—45s. per ton. The machine was removed to Northcote about four years ago. At present the stone has to be carted to the Homeward Bound Machine at a cost of 16s. per ton, and crushing costs 25s. per ton.

B. B. CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
April, 1878	No. 1 ...	Victory ...	31 0	14 13 0	
May, "	No. 1 S.	" ...	31 0	15 4 19	
" "	...	Vulcan ...	3 0	6 0 0	
Jan., 1880	P.C. ...	" ...	17 0	25 13 0	
June, "	" ...	Pers'ver'nce	24 10	18 5 0	
" 1881	...	" ...	31 0	42 4 0	
" 1882	Extended	" ...	143 0	161 15 0	
Aug., 1883	...	" ...	76 10	117 0 0	

IRONCLAD CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
July, 1877	...	Victory ...	15 0	49 5 0	
April, 1878	P.C. ...	" ...	7 0	32 0 0	
Dec., "	" ...	Vulcan ...	21 0	49 8 0	
May, 1879	" ...	Victory ...	6 0	23 0 0	

IRONCLAD CRUSHINGS—*continued.*

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
Jan., 1881	P.C. ...	Pers'ver'nce	16 0	35 11 0	
June, 1881	" ...	" ...	25 0	20 6 0	

INFLEXIBLE CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
Jan., 1878	P.C. ...	Victory ...	23 10	63 14 16	
June, "	...	" ...	21 0	8 10 0	
May, 1879	P.C. ..	Vulcan ...	17 0	62 10 0	
Nov., "	...	" ...	20 0	36 0 0	
Jan., 1881	Extended	Pers'ver'nce	45 0	74 17 0	
June,	...	" ...	9 10	33 13 0	

SURPRISE CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
July, 1877	P.C. ..	Victory ...	35 0	54 5 0	
April, 1878	" ...	" ...	19 0	32 0 0	

VICTORY.

This reef lies about 300 yards west of the Trafalgar, which is about a quarter of a mile west of the machine site. The Victory runs north and south, and underlies to the west at 60 degrees. The country is greywacke and shale, vertical, and striking north-west and south-east. The deepest shaft on the

the Victory was 100 feet. Large quantities of stone have been raised, of which a great deal is still lying on the ground. It contains a little iron and copper pyrites, with an occasional visible speck of gold. The reef at its north end bifurcates at an angle of 15 degrees, and there are scattered workings on both branches. South of the bifurcation the cap of the reef has been worked continuously for at least 100 yards. The Nelson is the southward prolongation of the Victory. No stone was crushed from it, but a great deal lies on the ground. It contains some galena, besides iron and copper pyrites. It is rough and spongy in places, with ferruginous cavities.

VICTORY CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed. tns. cwt.	Yield of Gold. oz. dwt. gr.	Value of Gold, per oz. £ s. d.
July, 1877	P.C. ...	Victory ...	158 0	342 19 0	
Jan., 1878	Surface	,, ...	100 0	67 15 0	
Feb., ,,	Surface	,, ...	4 0	4 19 0	
,, ,,	P.C. ...	,, ...	29 0	64 15 0	
Mar., ,,	,, ...	,, ...	402 0	586 0 0	
June, ,,	,, ...	,, ...	160 0	165 0 0	
Aug., ,,	,, ...	,, ...	87 0	86 0 0	
Nov., 1879	...	Vulcan ...	4 0	8 0 0	
Jan., 1880	P.C. ...	,, ...	3 10	5 0 0	
April, ,,	,, ...	Pers'ver'nce	29 18½	41 14 0	
Dec., ,,	...	Vulcan ...	20 0	13 10 0	
,, ,,	P.C. ...	Pers'ver'nce	45 10	54 0 0	
May, 1881	...	,, ...	40 0	71 2 0	
May, 1882	P.C. ...	,, ...	123 0	119 0 0	
May, 1883	Extended	,, ...	156 0	143 0 0	

ADMIRAL NAPIER.

Date.	Part of Reef.	Machine.	Quartz Crushed. tns. cwt.	Yield of Gold. oz. dwt. gr.	Value of Gold, per oz. £ s. d.
May, 1878	P.C. ...	Victory ...	15 0	24 18 5	
Mar., 1879	,, ...	,, ...	13 10	28 0 0	
June, ,,	,, ...	,, ...	31 0	35 0 0	
...	No. 1 S.	...	9 0	16 5 0	

GENERAL SARSFIELD CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed. tns. cwt.	Yield of Gold. oz. dwt. gr.	Value of Gold, per oz. £ s. d.
Apr., 1878	P.C. ...	Victory ...	23 0	29 19 0	
,, ,,	,, (Sarsfield)	Vulcan ...	23 0	30 0 0	

GREGORY CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed. tns. cwt.	Yield of Gold. oz. dwt. gr.	Value of Gold, per oz. £ s. d.
May, 1878	P.C. ...	Victory ...	39 0	25 7 15	
Mar., 1879	,, ..	Vulcan ...	15 0	15 5 0	

GLENDOWER CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed. tns. cwt.	Yield of Gold. oz. dwt. gr.	Value of Gold, per oz. £ s. d.
Jan., 1878	...	Victory ...	7 3	8 15 0	
April, ,,	...	,, ...	3 10	5 18 0	
May., ,,	P.C. ...	,, ...	3 10	6 4 19	
Nov., ,,	...	Vulcan ...	51 0	61 0 0	
,, ,,	...	,, ...	12 0	14 5 0	
May, 1879	P.C. ...	,, ...	36 0	25 0 0	

LADY BURDETT COUTTS CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed. tns. cwt.	Yield of Gold. oz. dwt. gr.	Value of Gold, per oz. £ s. d.
May, 1878	No. 2 ...	Victory ...	25 0	10 15 0	
Mar., 1880	...	Perseverance	7 4	2 17 0	
April, ,,	P.C. ...	,, ...	60 0	18 0 0	

NEW ZEALAND CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed. tns. cwt.	Yield of Gold. oz. dwt. gr.	Value of Gold, per oz. £ s. d.
Jan., 1878	P.C. ...	Goldfinder	29 0	7 15 0	
April, ,,	,, ...	Victory ...	29 0	27 0 0	

PLUTARCHO CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed. tns. cwt.	Yield of Gold. oz. dwt. gr.	Value of Gold per oz. £ s. d.
April, 1878	No. 2 N.	Victory ...	20 0	5 2 0	
May, ,,	,,	,, ...	18 0	5 8 4	

PRIDE OF THE NORTH CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed. tns. cwt.	Yield of Gold. oz. dwt. gr.	Value of Gold per oz. £ s. d.
May, 1878	No. 1 ...	Victory ...	9 0	8 0 0	
July, ,,	P.C. ...	Spring Gully (Springtown)	10 0	15 9 0	

RISE AND SHINE CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed. tns. cwt.	Yield of Gold. oz. dwt. gr.	Value of Gold per oz. £ s. d.
June, 1878	...	Victory ...	8 10	8 14 0	
July, ,,	...	,, ..	8 10	8 4 0	

SAXBY CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed. tns. cwt.	Yield of Gold. oz. dwt. gr.	Value of Gold per oz. £ s. d.
May, 1878	P.C. ..	Victory ...	22 0	10 12 9	

STAR CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed. tns. cwt.	Yield of Gold. oz. dwt. gr.	Value of Gold per oz. £ s. d.
May, 1878	P.C. ..	Victory ...	11 0	5 3 0	

SUNRISE CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed. tns. cwt.	Yield of Gold. oz. dwt. gr.	Value of Gold per oz. £ s. d.
May, 1878	P.C. ...	Victory ...	7 0	3 11 0	

SWIFT CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed. tns. cwt.	Yield of Gold. oz. dwt. gr.	Value of Gold per oz. £ s. d.
Aug., 1878	P.C. ...	Pr. of Wales	5 0	5 0 0	

THREE BELLS CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed. tns. cwt.	Yield of Gold. oz. dwt. gr.	Value of Gold per oz. £ s. d.
Aug., 1878	...	Victory ...	27 10	22 0 0	

WARRIOR CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed. tns. cwt.	Yield of Gold. oz. dwt. gr.	Value of Gold per oz. £ s. d.
April, 1878	P.C. ...	Victory ...	15 0	10 9 0	
May, ,,	,, ...	,, ...	15 0	10 8 0	

WELCOME STRANGER CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed. tns. cwt.	Yield of Gold. oz. dwt. gr.	Value of Gold per oz. £ s. d.
June, 1877	P.C. ...	Lodestone	4 0	22 19 0	3 17 6
April, 1878	,, ...	Victory ...	47 0	143 0 0	
June, ,,	...	,, ...	102 0	145 0 0	
July, ,,	P.C. ...	,, ...	100 0	142 13 0	
Nov., ,,	,, ...	,, ...	113 0	130 5 0	
,, ,,	No. 1 N.	,, ...	6 0	6 15 0	
Jan., 1879	P.C. ...	,, ...	40 0	18 12 0	
Mar., ,,	,, ...	,, ...	65 0	29 3 0	
June, ,,	,, ...	,, ...	100 0	65 0 0	

COMSTOCK CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed. tns. cwt.	Yield of Gold. oz. dwt. gr.	Value of Gold per oz. £ s. d.
May, 1877	P.C. ...	Hercules...	14 0	20 0 0	
Feb., 1878	Surface	Victory ...	37 0	24 5 0	

NORTHCOTE DISTRICT.

MONARCH. (*Diagram* 15.)

Plan of cap of reef showing shafts. Scale, 128 feet to an inch:—

a. Whip shaft, 200 feet on underlie.
b. Shaft at present in use, 60 feet vertical and 60 feet on underlie.
c. Shaft, 30 feet.
d. Whip shaft, 280 feet on underlie.
e. Whip shaft.

The output of the Monarch Reef as been excelled by few of the reefs on the field. It has been worked very extensively, but the mine at present is on a restricted footing. Mr. Buls, the managing partner, kindly furnished me with the following sketch of the workings (*Diagram* 16). The

The reef, as seen in the opencast workings between shafts A and B, has about four feet of quartz. The underlie is about 70 degrees to east-north-east. Shaft B was the only one accessible at the date of my visit (14th April, 1884). Where the vertical shaft bottomed on the reef the quartz was five feet thick in the roof. In the stope above the 80-feet drive the quartz contains much "mundic"—chiefly copper pyrites, with a little galena, containing now and then a speck of gold. In the pass at the end of the drive the best part of the reef is in the middle, where a good deal of gold is visible in the mundic. The part of the reef adjacent to the hanging-wall contains large bunches of copper pyrites.

From shaft A there was stoped out to the depth of 200 feet a shoot of stone, which at the surface extended twenty-five feet in the direction of shaft B, but narrowed till it reached the shaft at the bottom. The water stands seventy feet deep in the shaft. An enormous quantity of stone was stoped out from shaft D from a shoot which dipped to the south-south-east.

The reef was worked for a good distance to the north-north-west of the company's workings, and to about the same depth.

MONARCH CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed. tns.	cwt.	Yield of Gold. oz.	dwt.	gr.	Value of Gold per oz. £ s. d.
May, 1877	P.C. ...	Monarch ...	72	0	165	11	0	
June, ,,	,, ...	,, ...	122	0	243	3	0	
July, ,,	...	,, ...	55	0	69	6	0	
,, ,,	...	,, ...	150	0	219	19	0	
Jan., 1878	P.C. ...	,, ...	100	0	78	14	0	3 11 1
Feb., ,,	,, ...	,, ...	100	0	84	11	0	
,, ,,	,, ...	,, ...	100	0	91	13	0	
,, ,,	No. 1 ...	,, ...	89	0	73	17	8	
Mar., ,,	No. 1 S.	,, ...	35	0	65	12	0	
,, ,,	P.C. ...	,, ...	100	0	107	12	0	
April, ,,	,, ...	,, ...	110	14	291	3	11	
,, ,,	,, ...	,, ...	95	0	70	0	0	
May, ,,	,, ...	,, ...	150	0	233	0	0	
July, ,,	,, ...	,, ...	230	0	465	0	0	
,, ,,	,, ...	,, ...	130	0	108	12	0	
Aug., ,,	,, ...	,, ...	328	0	473	13	0	
Sep., ,,	,, ...	,, ...	150	0	221	10	0	
,, ,,	,, ...	,, ...	150	0	201	0	0	
Jan., 1879	,, ...	,, ...	98	0	133	0	0	
,, ,,	,, ...	,, ...	170	0	239	10	0	
Feb., ,,	Lease ...	,, ...	100	0	117	0	0	
Mar., ,,	...	,, ...	160	0	177	4	0	
,, ,,	,, ...	,, ...	80	0	86	10	0	
June, ,,	P.C. ...	,, ...	34	0	23	6	0	
July ,,	Lease ...	,, ...	130	0	115	0	0	
Aug., ,,	,, ...	,, ...	180	0	157	10	0	
Sep., ,,	,, ...	,, ...	120	0	137	0	0	
Nov., ,,	P.C. ...	,, ...	180	0	206	5	0	
Dec., ,,	...	,, ...	185	0	313	16	0	
April, 1880	Lease ...	,, ...	85	0	82	0	0	
,, ,,	,, ...	,, ...	120	0	103	12	0	
June, ,,	P.C. ...	,, ...	60	0	52	0	0	
,, ,,	Surface	,, ...	70	0	43	5	0	
July, ,,	...	,, ...	60	0	50	0	0	
Aug., ,,	Lease ...	,, ...	50	0	99	0	0	
Sep., ,,	,, ...	,, ...	56	0	70	15	0	
Dec., ,,	,, ...	,, ...	45	0	83	0	0	
,, ,,	,, ...	,, ...	42	0	45	15	0	
July, 1881	...	,, ...	124	0	130	1	0	
Sep., ,,	...	,, ...	35	0	49	5	0	
Nov., ,,	...	,, ...	50	0	20	9	0	
,, ,,	...	,, ...	30	0	24	16	0	
April, 1882	Lease ...	,, ...	140	0	87	10	0	
May, ,,	...	,, ...	110	0	82	0	0	
Sep., ,,	Lease ...	,, ...	230	0	155	14	0	
Oct., 1883	,, ...	,, ...	55	0	37	0	0	

MOUNTAINEER CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed. tns.	cwt.	Yield of Gold. oz.	dwt.	gr.	Value of Gold per oz. £ s. d.
April, 1877	P.C. ...	Monarch	51	0	201	0	0	
June, ,,	...	,, ...	55	0	193	4	0	
July, ,,	No. 1 ...	,, ...	60	0	170	8	0	
Feb., 1878	...	Melbourne	135	10	324	0	0	

MOUNTAINEER CRUSHINGS—*continued.*

Date.	Part of Reef.	Machine.	Quartz Crushed. tns.	cwt.	Yield of Gold. oz.	dwt	gr.	Value of Gold per oz. £ s. d.
June, 1878	P.C. ...	Monarch	324	0	910	0	0	
July, ,,	P. Area	Melbourne	4	0	3	18	0	
Aug., ,,	No. 1 N.	,, ...	191	0	299	14	0	
May, 1879	P.C. ...	Eleanor ...	58	0	75	0	0	
June, ,,	,, ...	,, ...	170	0	144	0	0	
,, ,,	No. 1 S.	,, ...	25	0	10	16	0	
Oct., ,,	No. 1 ...	,, ...	63	0	250	7	0	
,, ,,	P.C. ...	,, ...	38	0	205	7	0	
May, 1880	...	Monarch	39	0	33	0	0	
June, ,,	P.C. ...	Melbourne	64	0	58	3	0	
July, 1881	...	Monarch	17	10	49	10	0	

CENTENNIAL CRUSHINGS:

Date.	Part of Reef.	Machine.	tns.	cwt.	oz.	dwt	gr.	£ s. d.
June, 1878	...	Melbourne	7	5	3	10	0	
July, ,,	P.C. ...	,, ...	73	3	287	2	0	
April, 1879	Lease 15	,, ...	96	0	375	2	0	
Oct., ,,	,, ...	Centennial	150	0	175	0	0	
Nov., ,,	...	Melbourne	90	0	177	12	0	
Dec., ,,	...	,, ...	90	0	124	0	0	
Jan., 1880	Lease ...	,, ...	55	0	58	10	0	
May, ,,	...	,, ...	50	0	78	4	0	
June, ,,	P.C. ...	,, ...	50	0	78	14	0	
July, ,,	...	,, ...	78	0	88	0	0	

MÀRIA CRUSHINGS.

Date.	Part of Reef.	Machine.	tns.	cwt.	oz.	dwt	gr.	£ s. d.
May, 1877	P.C. ...	Monarch	48	10	68	0	0	
Mar., 1878	,, ...	,, ...	60	0	87	14	0	
Aug., ,,	,, ...	Melbourne	65	0	55	0	0	
Sep., 1879	...	Goldfinder	3	0	4	0	0	
Nov., ,,	...	Melbourne	68	0	45	14	0	
Mar., 1880	P.C. ...	,, ...	30	16	35	6	0	
Oct., ,,	...	,, ...	89	0	58	12	0	
April, 1881	...	,, ...	81	0	78	15	0	
June, ,,	...	Centennial	66	0	71	15	0	
Sep., ,,	...	,, ...	47	0	26	0	0	

CHRISTMAS CRUSHINGS.

Date.	Part of Reef.	Machine.	tns.	cwt.	oz.	dwt	gr.	£ s. d.
Mar., 1878	P.C. ...	Melbourne	67	0	78	0	0	
Aug., ,,	,, ...	,, ...	30	0	18	10	0	

DOWNPATRICK CRUSHINGS.

Date.	Part of Reef.	Machine.	tns.	cwt.	oz.	dwt	gr.	£ s. d.
April, 1878	P.C. ..	Monarch B	20	0	52	3	6	
June, ,,	...	Melbourne	4	5	11	8	0	
Oct., ,,	P.C. ...	,, ...	11	0	22	15	0	
May, 1879	,, ...	,, ...	9	0	5	9	0	
Mar., 1880	Lease ...	,, ...	35	9	27	11	0	
Oct., ,,	...	,, ...	13	0	17	6	0	

JUST IN TIME.

I visited this reef in April last. The following are plans of the cap and of the workings (*Diagram* 17)—

a. Shaft 30 feet on underlie.
b. Shaft 60 feet on underlie.
c. Shaft 150 feet on underlie.
d. Shaft 150 feet on underlie.
e. Shaft 150 feet on underlie.
f. Shaft 100 feet on underlie.
g. Vertical shaft cutting reef at 40 feet.
h. Vertical shaft cutting reef at 45 feet. (*Diagram* 18.)

The reef underlies to the west at 40 degrees. Its character is well seen at the top of the skids in shaft *d*. The quartz is there 2 feet thick, but a little to the south it is interrupted with shaley "mullack." The quartz is milk-white, with vertical joints, and now and then a flake of pyrites or galena. At 80 feet on the underlie is a block, from which 218 tons have just been taken, which are being crushed at the Enterprise Mill. A few pillars left to support the roof show the quartz to have been here 2½ feet thick, the bottom part blue and streaked with carbonate of lead. The lowest 40 feet in the shaft have not yet been worked. At the bottom is the water level, but the quantity of water is quite trifling. Just at the water level is a fine reef of quartz, 2½ feet thick, seamed with red iron oxides, which pass in the face into black decomposing arsenical pyrites. One 8-inch vein in the centre is almost entirely composed of arsenical pyrites. The gold averages £3 10s. per ounce.

JUST IN TIME CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
Sep., 1877	P.C. ...	Pr. of Wales	632 0	696 0 0	
Oct., ,,	,, ...	,, ...	38 0	29 3 10	
Feb., 1878	,, ...	,, ...	199 0	346 5 12	
April, ,,	...	,, ...	94 0	71 16 0	
May, ,,	...	,, ...	120 0	475 18 0	
July, ,,	No. 1 S.	,, ...	52 0	54 2 0	
,, ,,	No. 1 N.	,, ...	30 10	59 15 0	
Mar., 1879	Lease ...	,, ...	285 0	412 8 0	
July, ,,	P.C. ...	Lady Marianne	107 0	152 4 0	
Mar., 1880	Lease ...	,, ...	150 0	508 4 0	
May, 1881	...	,, ...	110 0	60 10 0	
Oct., ,,	...	,, ...	120 0	147 13 0	
Sep., 1882	...	Enterprise	118 0	175 15 0	
Aug., 1883	...	,, ...	240 0	379 17 0	

AURORA CRUSHINGS.

May, 1877	P.C. ...	Monarch ...	7 0	17 10 0	
June, ,,	,, ...	,, ...	7 0	10 0 0	
Oct., 1879	,, ...	Centennial	150 0	175 0 0	

ENTERPRISE CRUSHINGS.

June, 1877	P.C. ...	Lodestone	40 0	44 15 0	
Mar., 1878	,, ...	Prince of Wales	54 0	92 15 0	
,, ,,	,, ...	Lodestone	54 0	40 13 0	
June, ,,	No. 1 S.	Prince of Wales	12 0	6 8 0	
Oct., ,,	P.C. ...	,, ...	56 0	93 0 0	
July, 1879	,, ...	Lady Marianne	40 0	55 0 0	
,, ,,	,, ...	,, ...	45 0	53 2 0	
Feb., 1880	,, ...	Enterprise	75 0	55 12 0	
Mar., ,,	Tribute No. 1	,, ...	39 0	11 5 0	
,, ,,	Tribute No. 2	,, ...	91 0	23 5 0	
May, ,,	Extended	,, ...	240 0	122 0 0	
June, ,,	,,	,, ...	280 0	124 0 0	
Nov., ,,	,,	,, ...	37 0	19 0 0	
Dec., ,,	...	,, ...	40 0	6 17 0	
,, ,,	...	,, ...	22 0	7 13 0	
,, ,,	...	,, ...	80 0	18 14 0	
,, ,,	...	,, ...	11 0	10 6 0	
Jan., 1881	Extended	,, ...	50 0	8 15 0	
,, ,,	...	,, ...	36 0	12 10 0	
Sep., ,,	...	,, ...	75 0	24 17 0	
Nov., ,,	...	,, ...	68 0	24 17 0	
,, ,,	...	,, ...	103 0	37 12 0	

CAMBRIA CRUSHINGS.

July, 1877	P.C. ...	Vulcan ...	16 0	41 0 0	
Apr., 1878	...	Monarch ...	15 0	19 0 0	
May, 1879	P.C. ...	Melbourne	52 12	46 7 0	
,, ,,	,,	,, ..	23 0	19 12 0	

AUSTRALIAN CRUSHINGS.

Dec., 1879	..	Brisbane ...	64 10	76 15 0	
Jan., 1880	...	Lady Marian	45 0	14 17 0	
Oct., ,,	...	Pers'v'rance	not giv'n	3 13 0	
Jan., 1881	...	Brisbane ...	6 0	13 0 0	
Oct., 1880	Austral'n Extended	Pers'v'rance	189 0	140 14 0	

AUSTRALASIA CRUSHINGS.

Oct., 1877	..	Prince of Wales	20 0	32 0 0	
May, 1878	..	,, ...	5 0	5 6 0	
Aug., ,,	.	,, ...	45 0	23 1 0	
Oct., ,,	...	,, ...	23 0	18 14 0	
Jan., 1879	..	,, ...	70 0	17 17 0	
Feb., ,,	.	,, ...	20 0	14 4 0	
Oct., ,,	..	Marianne	10 0	15 0 0	

ADELAIDE CRUSHINGS.

April, 1878	.	Melbourne	12 0	15 0 0	
June, ,,	..	,, ...	10 0	9 12 0	

ALICE CRUSHINGS.

Jan., 1878	P.C. ..	Melbourne	12 0	57 19 0	
May ,,	,, ...	,, ...	20 0	13 0 0	
June, ,,	,, ..	,, ...	4 10	2 6 0	
Oct., ,,	Alice and Galena Stone	,, .	10 0	9 3 0	

ARIADNE CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
Jan., 1878	..	Prince of Wales	26 0	57 18 12	

BELFAST CRUSHINGS.

Jan., 1878	...	Prince of Wales	30 0	176 11 0	
Oct., ,,	P.C. ...	Melbourne	116 0	346 18 0	
Feb., 1879	,, ...	Prince of Wales	34 0	182 10 0	
Aug., ,,	,, ...	Lady Marian	19 10	19 0 0	
Dec., ,,	...	,, ...	30 0	40 0 0	
June, 1880	P.C. ...	,, ...	12 0	17 7 0	
Nov., ,,	....	,, ...	25 0	32 7 0	

BOUGH SHED CRUSHINGS.

June, 1881	...	Lady Marianne	13 0	21 7 0	

DISRAELI CRUSHINGS.

Feb., 1878	P.C. ...	Prince of Wales	199 0	346 5 12	
June, ,,	,, ..	,, ...	24 0	39 19 0	
Nov., 1879	,, ...	Lady Marianne	10 0	17 1 0	
June, 1880	P.C. ...	,, ...	12 0	35 13 0	
,, ,,	..	,, ...	5 0	8 2 0	
July, ,,	...	,, ...	9 0	14 19 0	
,, ,,	...	,, ...	13 0	33 17 0	
June, 1881	...	,, ...	11 0	17 6 0	
Nov., ,,	...	,, ...	20 0	42 13 0	
Sep., 1882	Extended	,, ...	20 0	90 10 0	

ENDEAVOUR CRUSHINGS.

Feb., 1878	...	Melbourne	80 10	74 0 0	
June, ,,	...	,, ...	27 7	51 18 0	
Oct., ,,	P.C. ...	,, ...	85 0	64 8 0	

GROPER CRUSHINGS.

May, 1878	P.C. ...	Melbourne	16 0	8 12 0	

EXHIBITION CRUSHINGS.

May, 1877	P.C. ...	Monarch ...	27 0	205 0 0	
Jan., 1878	,, ...	,, ...	16 10	32 7 0	1 18 9

EXTENDED CRUSHINGS.

May, 1878	P.C. ...	Melbourne	65 0	296 18 0	
Oct., ,,	,, ...	,, ...	25 0	51 18 0	
June, 1880	,, ...	Lady Marianne	52 0	137 5 0	
Oct., ,,	...	,, ...	10 0	11 6 0	

FLYING TURK CRUSHINGS.

Apr., 1878	P.C. ...	Monarch ...	25 0	39 0 0	

GLADSTONE CRUSHINGS.

Jan., 1878	...	Pr. of Wales	46 0	225 14 0	
Sep., ,,	P.C.	Melbourne	23 10	102 2 0	
Apr., 1879	,, ...	Pr. of Wales	17 0	137 5 0	
Oct., ,,	...	Lady Marianne	26 10	89 15 0	
Dec., 1880	...	,, ...	28 0	49 0 0	

HAMBURGH CRUSHINGS.

Aug., 1880	...	Monarch...	5 0	15 5 0	

HECTOR CRUSHINGS.

May, 1879	P.C. ...	Melbourne	36 0	48 0 0	

INDEPENDENT CRUSHINGS.

Feb., 1878	...	Monarch ...	13 0	65 2 0	
July, ,,	P.C. ...	Melbourne	15 7	105 18 0	
June, 1880	,, ...	Monarch ...	15 0	38 0 0	

LADY J. BEATRICE CRUSHINGS.

Feb., 1879	P.C. ..	Prince of Wales	16 0	92 4 0	

LONDON

LONDON CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed. tns. cwt.	Yield of Gold. oz. dwt. gr.	Value of Gold per oz. £ s. d.
Aug., 1878	P.C. .	Vulcan ...	10 0	10 10 0	
Sep., „	„ ...	Monarch ...	8 0	10 0 0	

LONDON AND MANCHESTER CRUSHINGS.

Oct., 1878	P.C. ...	Prince of Wales	13 0	17 7 0	
Jan., 1879	„ ...	„ ...	7 0	11 11 0	

LONG DICK CRUSHINGS.

April, 1878	...	Prince of Wales	21 0	26 10 0	

LUSITANIA CRUSHINGS.

Mar., 1878	P.C. ...	Prince of Wales	26 0	18 18 0	

MAGGIE PATERSON CRUSHINGS.

Feb., 1878	P.C. ...	Monarch ...	8 0	23 18 0	

MARY JANE BEATRICE CRUSHINGS.

Sep., 1878	P.C. ...	Melbourne	30 10	44 15 0	

MOLLY MALONE CRUSHINGS.

May, 1878	...	Vulcan ...	30 0	35 0 0	
May, 1879	P.C. ...	Melbourne	5 15	4 18 0	

MONKLAND CRUSHINGS.

Sep., 1877	P.C. ...	Prince of Wales	5 0	5 0 0	
Dec., 1879	...	Lady Marianne	49 0	20 10 0	
Feb., 1880	P.C. ...	Enterprise	33 0	14 0 0	

MOUNTAIN MAID CRUSHINGS.

Mar., 1878	P.C. ...	Monarch ...	20 0	60 14 0	
May, 1879	„ ...	Eleanor ...	6 0	2 6 0	
June, „	„ ...	„ ...	1 0		

NATIVE CRUSHINGS.

Oct., 1878	P.C. ...	Melbourne	13 10	15 6 0	

NAPPER TANDY CRUSHINGS.

June, 1880	...	Melbourne	39 0	29 0 0	
July, „	...	„ ...	39 0	29 2 0	
April, 1881	...	„ ...	40 0	32 5 0	

NEW CHUM CRUSHINGS.

July, 1877	...	Brisbane ...	19 0	9 2 12	

NORTHCOTE CRUSHINGS.

Mar., 1878	P.C. ...	Pr. of Wales	37 0	13 16 12	

ONWARD CRUSHINGS.

Oct., 1877	P.C. ...	Pr. of Wales	49 0	168 2 12	
Apr., 1878	...	„ ...	17 0	53 2 0	
„ „	...	„ ...	11 0	6 5 0	
June, „	P.C. ...	„ ...	50 0	49 14 0	
July, „	„ ...	„ ...	30 0	31 0 0	
„ „	„ ...	„ ...	32 0	24 15 0	
Feb., 1879	„ ...	„ ...	61 0	145 7 0	

PHŒNIX CRUSHINGS.

May, 1877	P.C. ...	Monarch ...	25 0	20 16 0	
Mar., 1879	„ ...	„ ...	24 0	19 17 0	
June, „	„ ...	„ ...	30 0	17 5 0	

PICKWICK CRUSHINGS.

Dec., 1877	..	Prince of Wales	36 0	57 6 0	
April, 1878		„ ...	10 0	18 14 0	
Aug., „	P.C. ..	„ ...	30 10	43 17 0	

PUBLIC PURSE CRUSHINGS.

Sep., 1880	...	Lady Marianne	19 0	12 0 0	
Nov., „	...	„ ...	31 10	7 1 0	

QUEEN'S BIRTHDAY CRUSHINGS.

Oct., 1879	...	Eleanor ...	22 0	61 0 0	

RIGHT BOWER CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed. tns. cwt.	Yield of Gold. oz. dwt. gr.	Value of Gold per oz. £ s. d.
May, 1877	P.C. ...	Monarch ...	11 0	24 15 0	
Feb., 1878	„ ...	„ ...	32 10	36 5 0	
Sep., „	„ ...	Melbourne	17 0	11 10 0	
Oct., „	„ ...	„ ...	13 10	11 18 0	
April, 1879	„ ...	„ ..	19 0	14 14 0	
Mar., 1880	...	Melbourne (Centennial)	8 0	2 18 0	

ROARING FUNNEL CRUSHINGS.

April, 1878	...	Prince of Wales	10 0	5 10 0	

ROSE OF ENGLAND CRUSHINGS.

April, 1877	P.C. ...	Melbourne	38 0	20 4 0	
June, „	„ ...	Vulcan ...	6 0	6 5 0	
July, „	„ ...	„ ...	31 0	16 18 0	

SAME-AS-USUAL CRUSHINGS.

Oct., 1879	...	Lady Marianne	73 0	85 8 0	
Feb., 1880	P.C. ...	„ ...	101 0	103 14 0	
Aug., „	...	„ ...	100 0	74 17 0	
Oct., „	...	„ ...	67 0	93 12 0	
May, 1883	Extended	Enterprise	232 0	182 16 0	

SECOND-TO-NONE CRUSHINGS.

April, 1878	...	Prince of Wales	11 10	3 5 0	

ST. KILDA CRUSHINGS.

May, 1877	P.C. ...	Vulcan ...	50 0	65 0 0	
Aug., 1879	„ ...	„ ...	75 0	51 10 0	
Nov., „	...	„ ...	20 0	22 0 0	
Sep., 1880	...	„ ...	16 0	52 0 0	
„ 1882	...	„ ...	22 0	24 10 0	
Aug., 1883	..	Pers'ver'nce	44 10	24 0 0	

SNOW KING CRUSHINGS.

Feb., 1878	P.C. ...	Monarch ...	17 0	9 4 0	

SUNBURST CRUSHINGS.

May., 1879	P.C. ...	Melbourne	100 0	21 3 0	

TRICKETT CRUSHINGS.

April, 1877	P.C. ...	X.L. ...	27 0	36 15 0	
Sep., „	„ ...	Hercules ...	28 0	23 19 0	
Mar., 1878	„ ..	Prince of Wales	37 0	66 3 0	
June, „	„ ...	„ ...	15 0	57 15 0	
Aug., „	„ ..	„ ...	18 15	31 12 0	
Oct., 1879	...	Lady Marianne	12 0	11 18 0	

TRIBUNE CRUSHINGS.

Mar., 1880	P.C. ...	Pers'ver'nce	4 3	5 0 0	
May, „	...	„ ...	12 0	11 8 0	

TWO GEORGES CRUSHINGS.

June, 1880	...	Lady Marianne	2 0	3 2 0	

TRACKERS' REEF CRUSHINGS.

May, 1883	...	Pers'ver'nce	52 10	57 0 0	

VANGUARD CRUSHINGS.

June, 1878	...	Prince of Wales	40 0	21 14 0	
Aug., ,	P.C. ...	„ ...	3 0	3 0 0	

YOU-NEVER-CAN-TELL CRUSHINGS.

Feb., 1877	P.C. ...	Prince of Wales	7 0	18 1 0	
May, „	No. 1 S.	Monarch ...	13 10	63 11 0	
„ „	P.C. ...	„ ...	41 0	40 0 0	
Sep., „	P.C. ..	Prince of Wales	29 0	13 0 0	
Oct., „	No. 2 ...	„ ...	10 0	12 6 0	
„ „	No. 1 ...	„ ...	24 0	23 17 12	
Oct., 1878	P.C. ...	„ ...	9 0	9 14 0	
Nov., 1880	...	Enterprise	40 0	55 5 0	
Dec., „	P.C. ...	„ ...	16 15	10 10 0	

MINNIE

MINNIE MOXHAM.

The Minnie Moxham Reef strikes east and west to west-north-west and east-south-east, and underlies to the south at 45 degrees.

I descended in April last by a shaft to 140 feet. This shaft bottomed on a shoot of good stone on the east or left side. The shoot was traced in a level to the east for about 25 feet, when it pinched out. It, however, went down strongly into the floor of the level. The shaft was continued down the underlie for 30 feet further, but was on a blank, so that the presu ption is that the shoot dips to the east. At the bottom of the underlie, a 4-inch vein of quartz occurs on the hanging-wall, with an inch and a-half of antimony glance on the bottom. The quartz itself is full of stibnite crystals. About 30 feet to the west of the bottom a shoot of good stone came in. It was left good under foot. I followed this shoot up by a pass to the east. In the pass, 25 feet up, is a large body of quartz, said to be rich in gold, and some masses of quartz full of stibnite. The quartz is four feet thick in places, and has some visible gold. It thins out, or nearly so, on being followed up to the west to a point where it is intersected by an underlie shaft, 100 feet west of the one I descended. I followed up this underlie shaft to the bottom of the vertical shaft. On the underlie, above the foot of the vertical shaft, some good crushings were obtained, but none down the underlie until near the bottom (220 feet), where over 200 tons of good stone were obtained.

MINNIE MOXHAM CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
Jan., 1878	P.C. ...	Melbourne	120 0	131 9 0	*3 19 9½
Mar., ,,	...	,, ...	80 0	106 19 0	
April, ,,	Surface	,, ...	12 0	6 17 0	
,, ,,	,, ...	,, ...	90 0	45 5 0	
July, ,,	P.C. ...	,, ...	82 10	106 0 0	
Feb., 1879	...	...	...	*60 18 0	*3 19 3¾
Oct., ,,	...	Lady Marianne	27 0	74 18 0	*4 0 0⅝
July, 1880	...	,, ...	117 0	153 16 0	*3 19 6⅜
Oct., ,,	No. 1 ...	,, ...	13 0	15 18 0	
Dec., ,,	...	,, ...	123 0	282 16 0	*4 0 1¾
June, 1881	...	,, ...	47 0	139 4 0	*3 19 8½
July, ,,	...	,, ...	...	*28 9 0	*3 19 4
Sep., 1882	...	Lady Marianne	108 0	457 0 0	*3 19 8¼
June, 1883	...	,, ...	*54 0	*162 5 0	*3 19 9½
Dec., ,,	...	,, ...	*180 0	*340 9 12	*3 19 9

* Not in official returns supplied by owners.

LIZZIE MOXHAM CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
Mar., 1878	P.C. ...	Melbourne	30 0	21 1 0	

MINNIE AND LIZZIE CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
June, 1881	...	Lady Marianne	48 0	28 9 0	

EMILY ANTIMONY MINE.

This lode appears to have been at one time a payable gold reef, but it is as a source of antimony ore that it now possesses its chief value. Its cap is seen on the right bank of Leadingham Creek, in nearly level country. It appears to be about 12 feet wide, and is traceable as a quartz reef for from half to three-quarters of a mile from west 40 degrees north to east 40 degrees south. The underlie is to south 40 degrees west at 80 degrees. The shoots of ore are said to dip to west 40 degrees north. The quartz is occasionally stained with antimony oxide. Some large holes have been sunk and a quantity of stone, which may be roughly estimated to contain 60 per cent. of ore and 40 per cent. of quartz, has been stacked. In one shaft a thickness of four feet of solid stibnite is seen. Very extensive smelting works have recently been erected at the south end of the line by the Northcote Antimony Smelting Company, under the management of Mr. Edwin R. Field.

EMILY CRUSHINGS.

Date.	Part of Reef.	Machine.	Quartz Crushed.	Yield of Gold.	Value of Gold per oz.
			tns. cwt.	oz. dwt. gr.	£ s. d.
June, 1878	...	Melbourne	26 12	33 0 0	
Oct., 1879	...	Lady Marianne	35 0	81 1 0	
,, ,,	...	,, ...	35 0	16 12 0	
June, 1880	...	,, ...	40 0	32 10 0	
Sep., 1880	...	Lady Marianne	120 0	58 5 0	
Nov., ,,	...	,, ...	44 0	40 17 0	
Jan., 1881	Extended	,, ...	60 0	40 13 0	
Nov., ,,	...	,, ...	22 0	12 15 0	

CRAIG'S LEASE.

Continuation of the Emily; distant about 1¼ miles from the Smelting Works; strike, west 40 degrees north. Where visible in a tunnel the lode contains from 6 inches to 2 feet of ore. About 250 tons of fairly good ore are paddocked, but the ore has a good deal of quartzose impurity.

MATILDA (PYLES').

Continuation of the Emily Lode; about 3 miles from the works. The strike of the lode here is west 15 degrees north. The underlie is to south 15 degrees west at 70 degrees. Where visible there are 8 feet of formation in all, including 1 foot of pure antimony ore on the hanging-wall, quartz 6 feet 3 inches to 6 feet 6 inches, and another vein of antimony ore 6 to 9 inches thick.

In addition to the returns of crushings recorded in the preceding pages, the Warden's books show a large amount of gold realised from crushings whose locality is ill, or not at all, defined. These I omit, but I refer to them here for the purpose of reminding the reader that the total amount of gold is not to be arrived at by adding up the amounts given in this report. The returns from the mines which can now be located, and which are therefore included in this report, sufficiently show the importance of the industry.

Yet the history of almost all the mines is very much alike, and very painful. Prospectors wandered over every ridge and climbed every hillside Wherever they saw a reef of quartz they searched its surface for specks of gold, then broke it up and pounded and washed the detritus. If the "prospect" was payable they settled down and sunk a shaft on the quartz. Sometimes the whole body of the quartz contained a payable proportion of gold, but its range both vertically and horizontally was limited. In other cases it was found that the gold was confined to a more or less narrow band in the quartz. In either case the auriferous band or "shoot" of quartz was followed where it proved payable and worked out both horizontally and vertically to its limits. As a rule, on the field, the vertical extent of the shoots has been much greater than the horizontal. Experience has shown only one case in which the shoot continued to a depth of nearly 400 feet. When the shoot has been exhausted, the miner, after sinking

down

down the underlie till he can no longer doubt the fact, begins to sink a vertical shaft to catch the same shoot at a lower level than that at which it was lost, and where he hopes it will "make" again. At this stage the co-operation of capital becomes indispensable if the mine is to be carried on. But it is just here that the miner has nothing tangible to offer the capitalist, unless the latter can be induced to believe that he is investing money in the carrying on of work on an unexhausted shoot of ore. Capitalists would often be quite willing frankly to risk money in finding a second shoot, in cases where the profits of the first were large. The Government might well encourage speculation of this kind by meeting it with a loan to the miner to enable him to take his place in the new company on satisfactory proof being adduced as to the value and extent of the payable ground, and on satisfactory report by competent mining surveyors. To meet such loans, a certain proportion of the profits of such mines as the owners register as "payable" should be paid into a Government fund. This fund could be drawn upon for a loan for exploratory work, but only in the event of outside capital being found willing to undertake a large proportion of the risk. It would not pay a miner to overstate his profits because of the larger sum he would have to pay into the fund, nor to understate them because his chances of getting capital to carry on the work would thus be thrown away.

To encourage the employment of capital some plan will have to be devised to give the capitalist better security over the property in which he risks his money than at present the miner has to offer him. To enable him to estimate justly the nature of the risk he undertakes and his chances of success, the "faces" of all excavations of whatever nature--stopes, drives, crosscuts, levels, or shafts—ought to be continually open to observation. No proposal for a loan should be entertained where these faces are concealed by water, mullock, dead fallen timber, or anything else. Further, a record of each mine, with plans, should be furnished to and filed by the Warden, whose duty it would be to determine whether the information supplied was sufficiently full and explicit. The skeletons of the plans should be supplied to the mine-owner by the mining surveyor, and the work plotted on them by the managers, with remarks as to where the stone was of rich percentage, where it was interrupted, &c., &c. Such plans would be invaluable in cases where a mine had been abandoned for a few years. As matters stand a person taking up an abandoned claim has to depend on hearsay evidence for the history of the mine. The experience of the former propric r is nearly worthless to him, although it may have cost hundreds or even thousands of pounds.

There is, in my opinion, a radical defect in the system of exploratory work usually carried on after the loss of a payable shoot. The shoots are nearly vertical, as a rule, and generally narrow. When the bottom of the shoot is arrived at beyond the possibility of doubt the endeavour is generally made to catch it at a depth where, according to popular theory, it will make again by sinking a vertical shaft. I believe that there is nothing to warrant this belief that the next body of ore will necessarily be a downward although interrupted prolongation of the last. On the contrary, I believe that better results would be obtained by searching for another shoot by driving right and left from the bottom of the lost shoot along the plane of the reef, unless the "formation" and walls have actually died out.

The Hodgkinson has little to fear or hope from a change in the nature of the ores, as experience hitherto has not shown that the gold is less free below than above the water level. In some other fields, Ravenswood for instance, the gold which in the upper level had been freed by the oxidation of the surrounding minerals was found below the water level to occur in new and complex combinations, the extraction of the gold from which required totally new machinery and treatment. On the other hand, the "mundic," as the complex ore is called, in some cases proved much richer than the "brownstone" of the upper levels, and contained copper, lead, silver, zinc, and other valuable minerals. With the exception of some of the mines at the Eastern Hodgkinson, the Hodgkinson mines contain little "mundic" below the water level, and the gold is as easily extracted from the stone as it is above that level. It is simply a question of finding other shoots after the exhaustion of the first. The future of the field depends, I am convinced, to a large extent on the action of the legislature in the interest of the industry. Whether the suggestions I have offered are or are not worthy of consideration, I hope that the law officers of the Colony can devise some means whereby the interest of the miner and the capitalist can be brought into unison

DOLERITE DYKES.

Two of these dykes occur on the hill south of the Glen Mowbray machine. Neither of them can be traced for any distance. They run nearly east and west. They are probably of much later date than any of the reefs, but as they do not intersect the reefs there is no direct evidence on the point.

GRANITE.

The packer's track from Port Douglas to the Hodgkinson runs between the main mass of the granite of Hann's table land and an outlying fragment to the north-west. It passes close by the junction of the granite with the stratified rocks (shales and greywackes). The granite sends numerous veins into the latter, which it indurates and contorts. Altogether it comports itself like an eruptive or plutonic rock, and there is no passage to suggest metamorphism. The granite passes about half-a-mile from the Minnie Moxham mine, and continues to the head of the Walsh. It is continuous and identical with the non-stanniferous granite of the township of Watsonville.

DESERT SANDSTONE OF MOUNT MULLIGAN.

The western edge of the goldfield is covered unconformably by a capping of newer stratified rocks which form the conspicuous table land known as Mount Mulligan.

The lowest bed is seen to rest to the west of Woodville on vertical greywackes and shales, which strike north and south. It consists of a coarse conglomerate with a grey matrix of granite debris. The pebbles are mainly of quartz and quartzite, with a few of porphyry and granite. There are also a good number of hardened greywackes and a few of hardened shale. This bed is horizontal and about 60 feet in thickness. It contains an occasional parting of red laminated mud or shale. The next succeeding bed is of red sandstone, and forms mural precipices 150 feet high, without an accessible gap from near the union to a long way round the south end of the table land, a distance of ten or twelve miles. The Mount Mulligan plateau still forms a stronghold of the aboriginal population. The same formation covers the palæozoic rocks over the greater part of the York Peninsula.

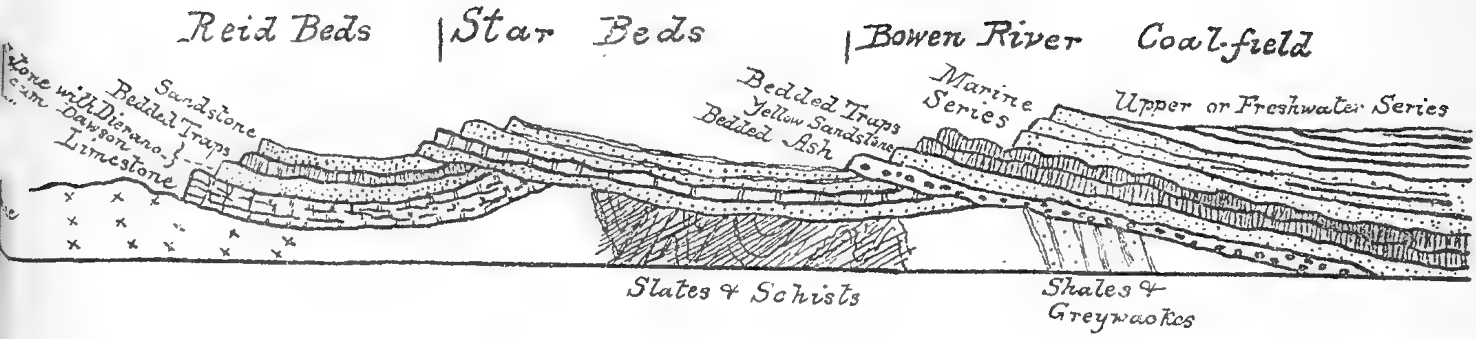
ROBERT L. JACK.

Geological Survey Office, 7th August, 1884.

Price 2s. 6d.]

By Authority: Edmund Gregory, Acting Government Printer, William street, Brisbane.

Diagram No. 1



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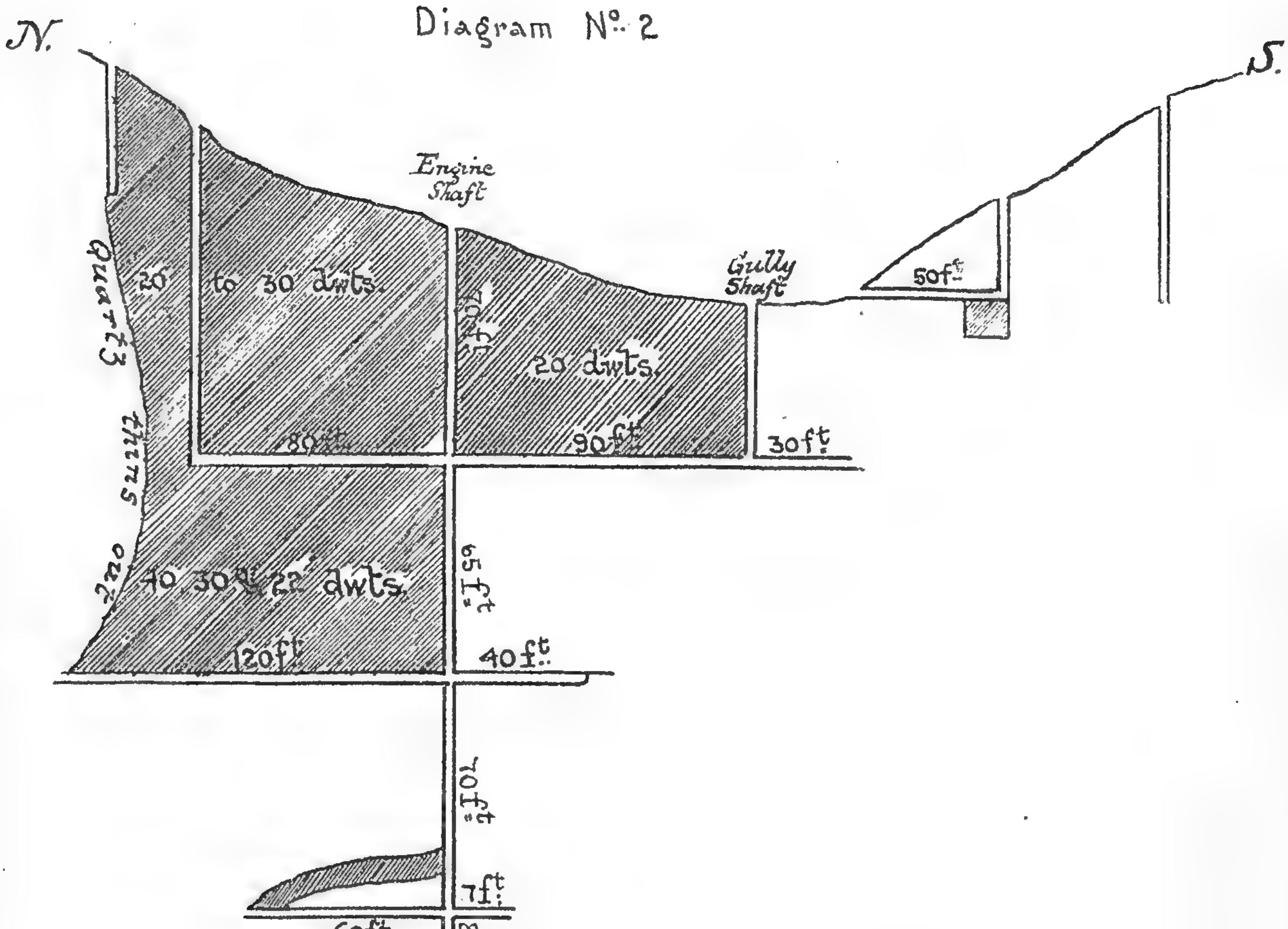
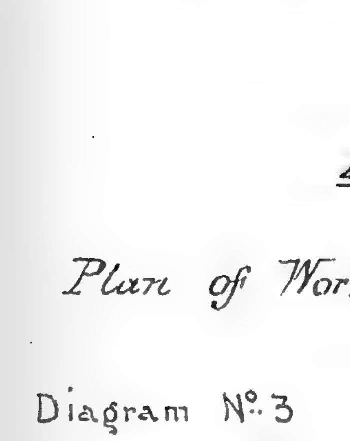


Plan of Workings _ Scale 64 Ft to an inch

Diagram No. 3



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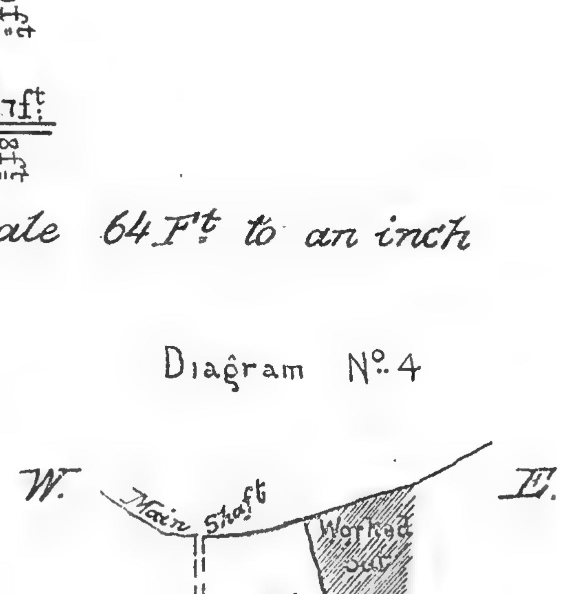

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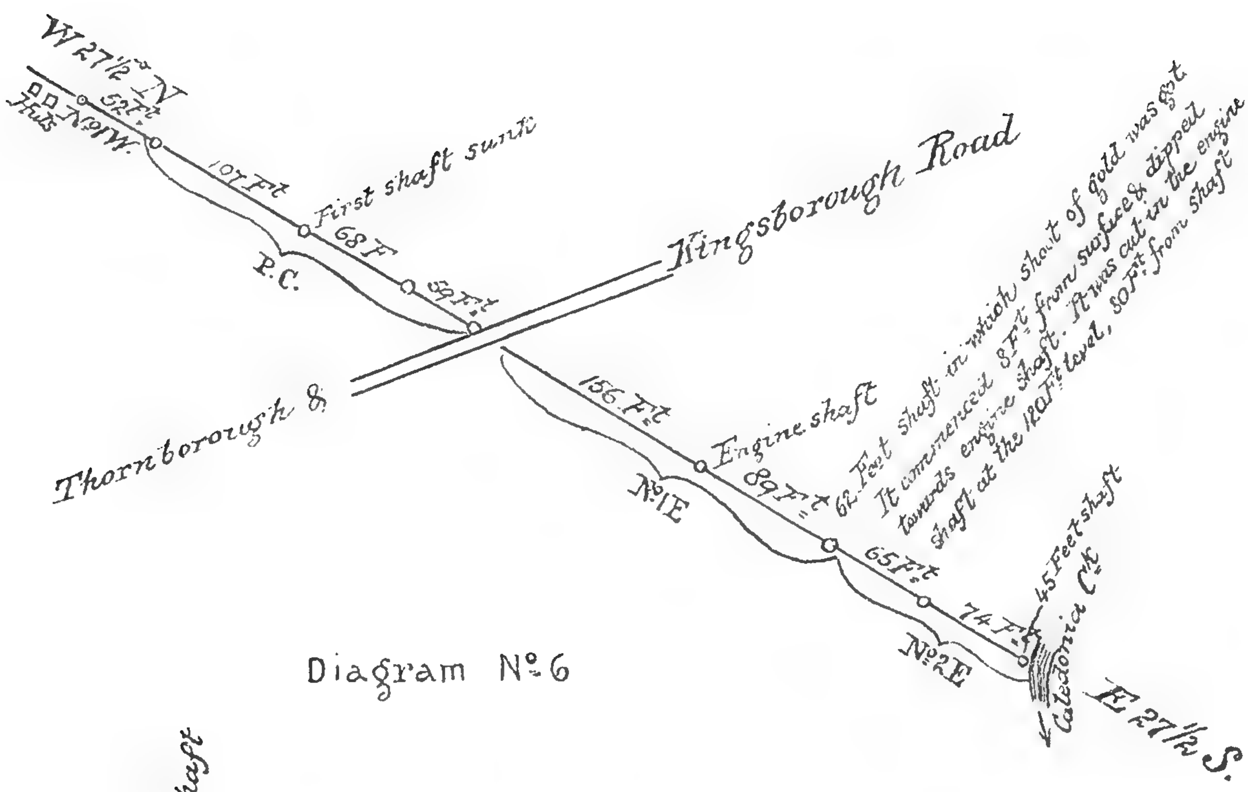

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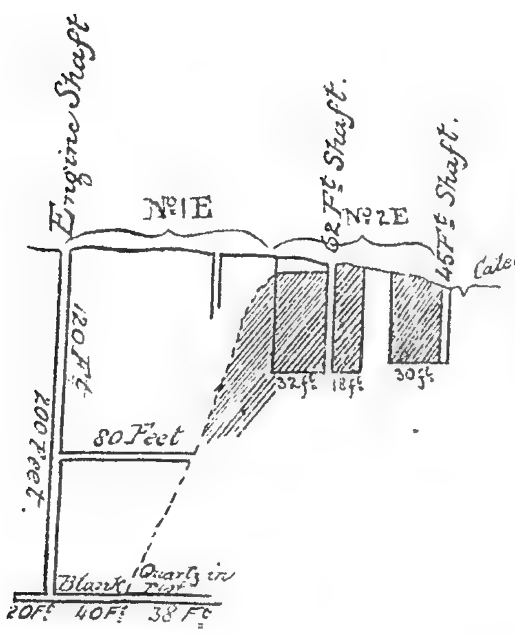

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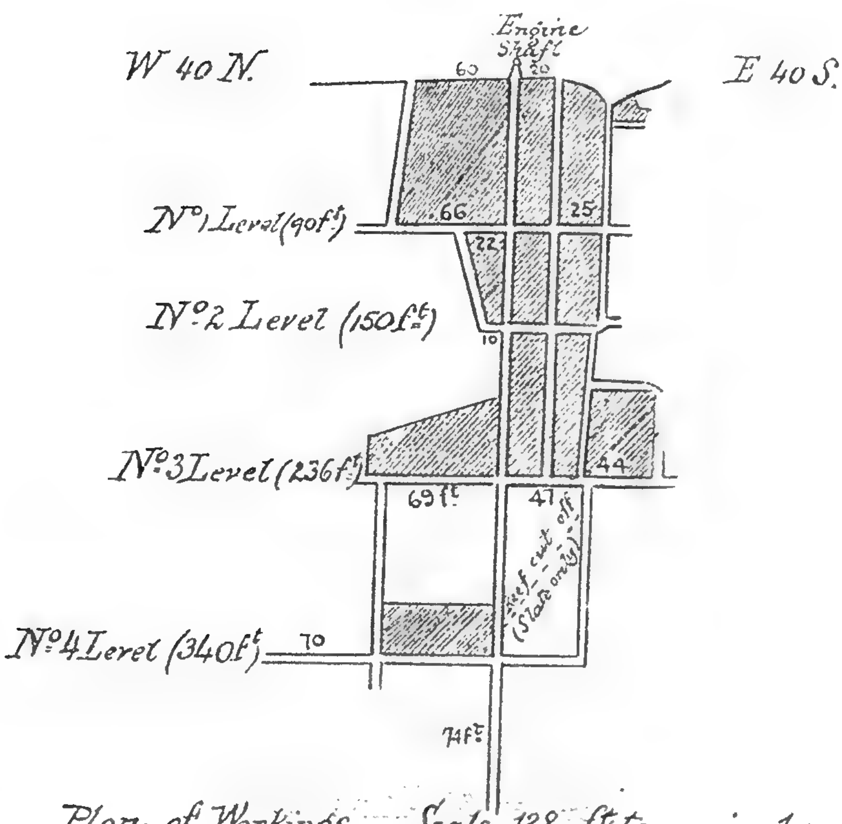
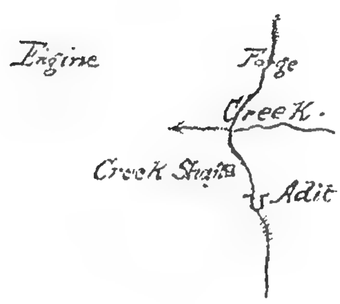


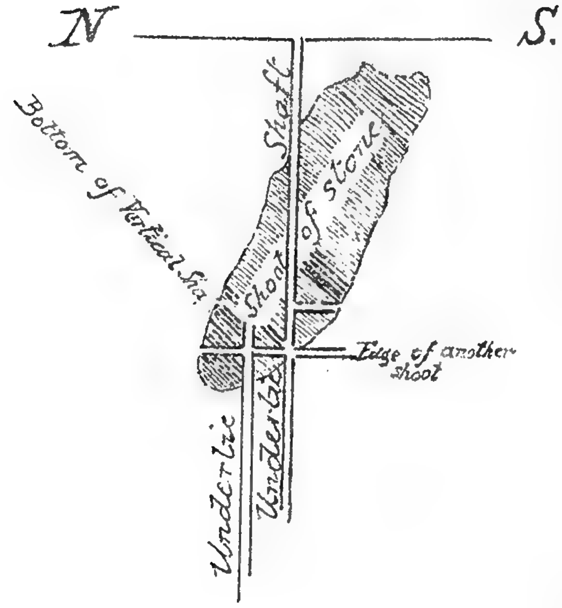
Plan of Workings. Scale 128 Ft to an inch.

Diagram No. 8



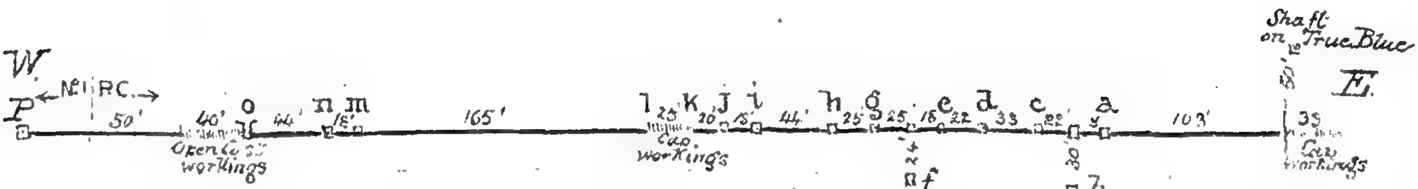
Sketch of Workings at Surface.

Diagram No. 9.



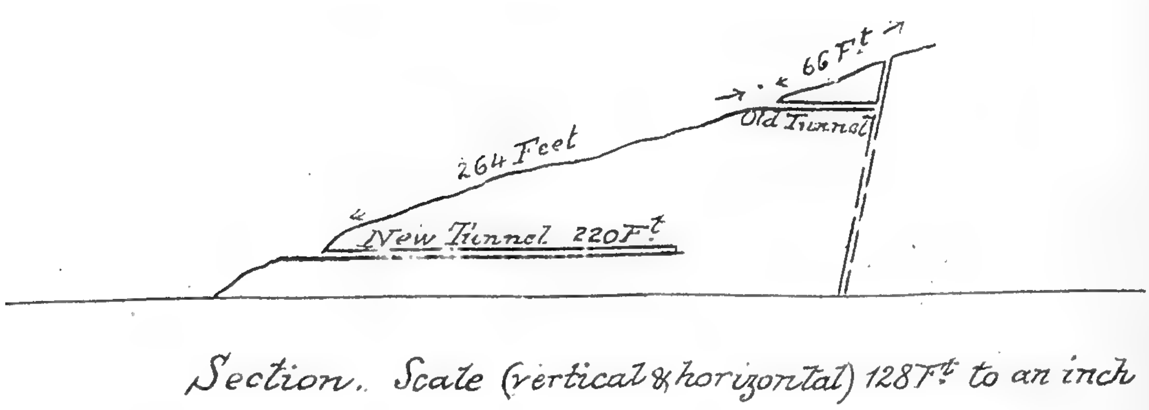
Scale 128 Feet to an inch.

Diagram No. 10



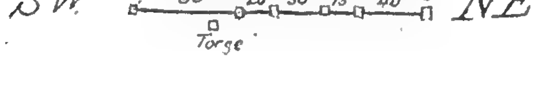
Rough Plan of Cap of Reef. - Scale 128 Feet to an inch.

Diagram No. 11



Section. Scale (vertical & horizontal) 128 Ft. to an inch

Diagram No. 12.



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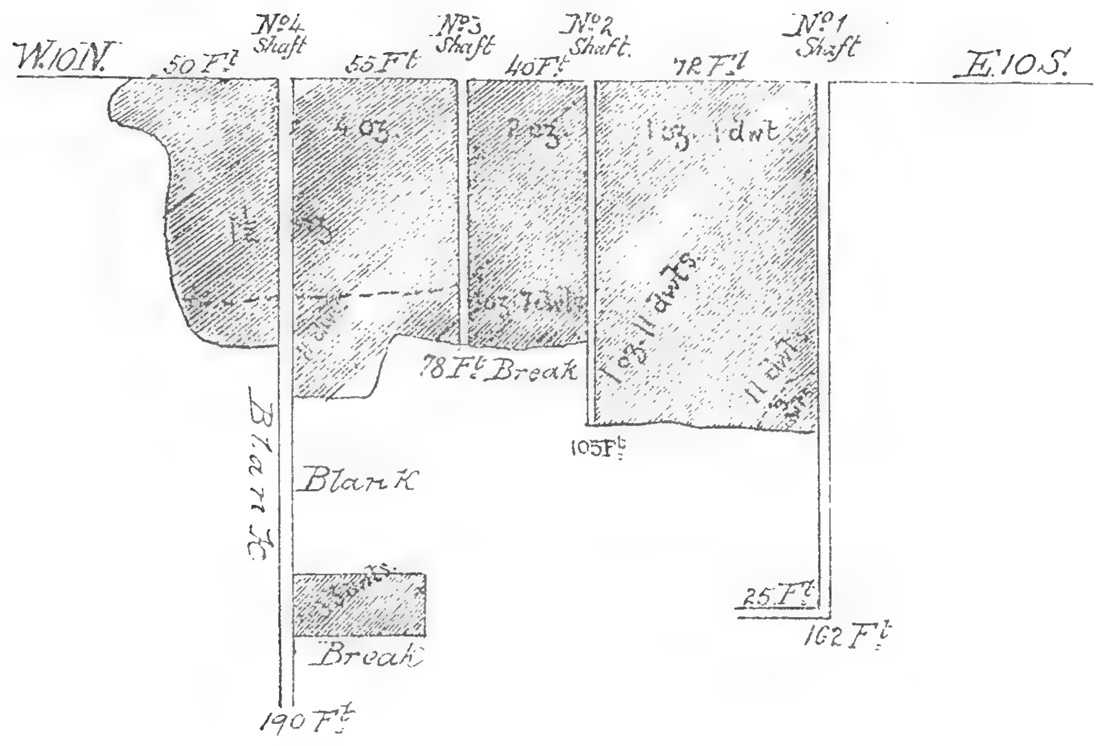
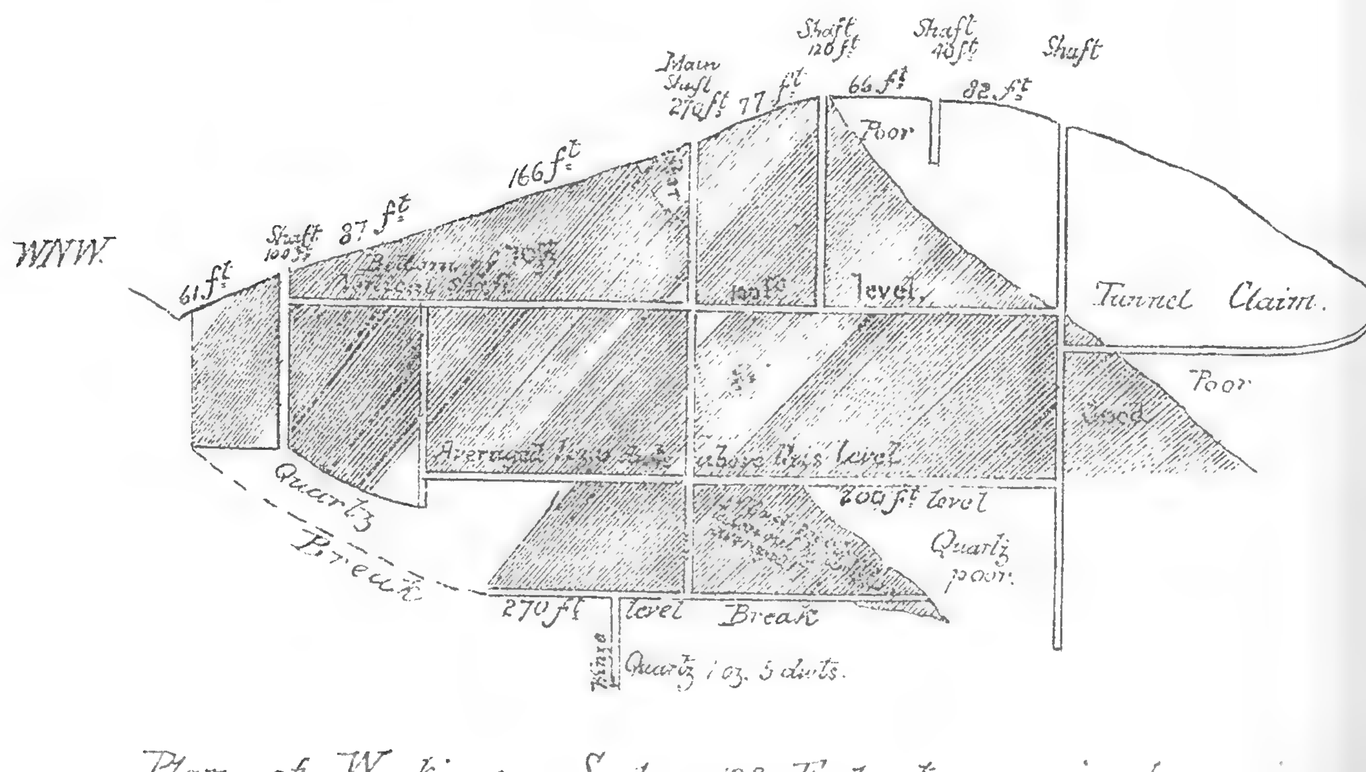


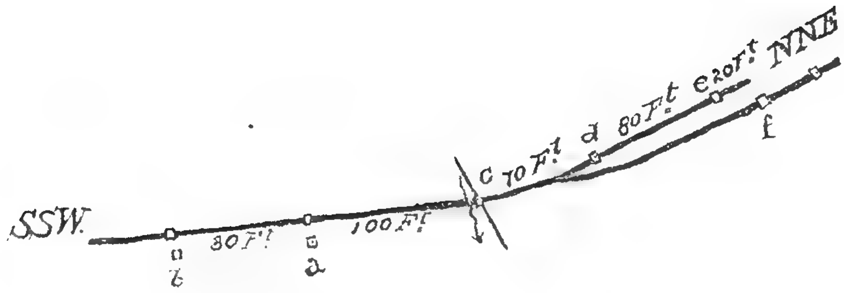
Plan of Workings. Scale 64 Ft. to an inch.

Diagram No. 14.



Plan of Workings, Scale 128 Feet to an inch

Diagram No. 15.



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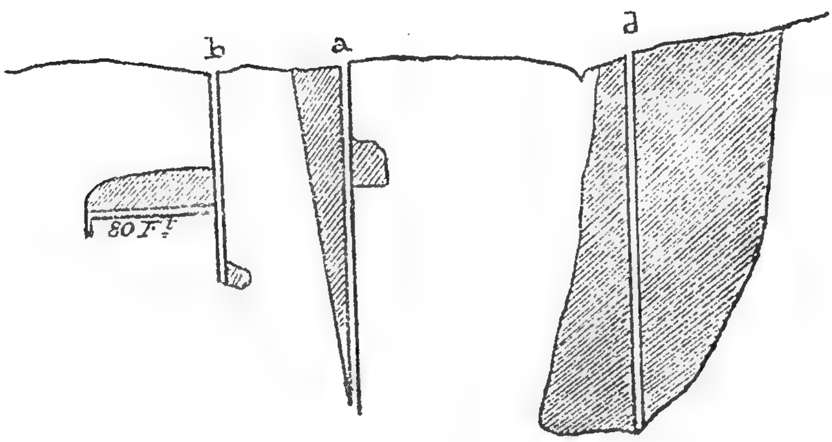

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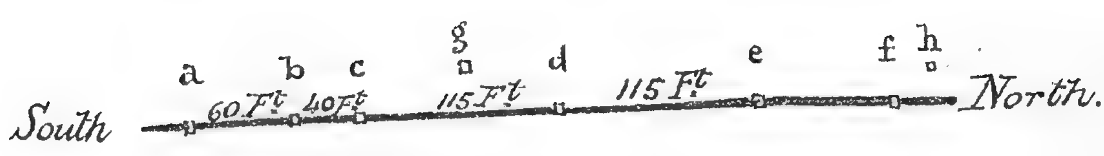

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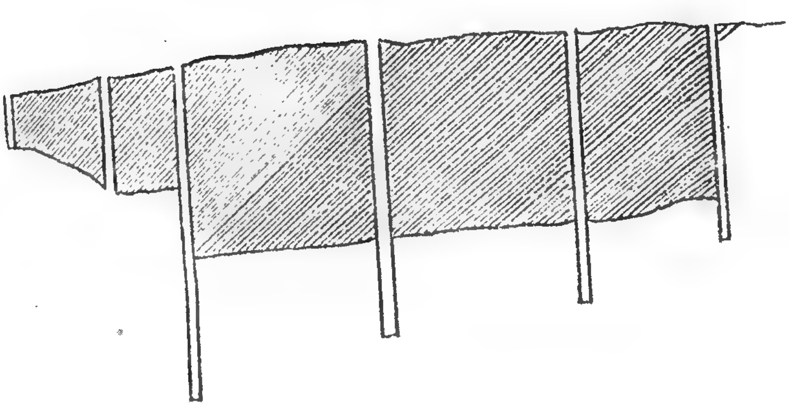
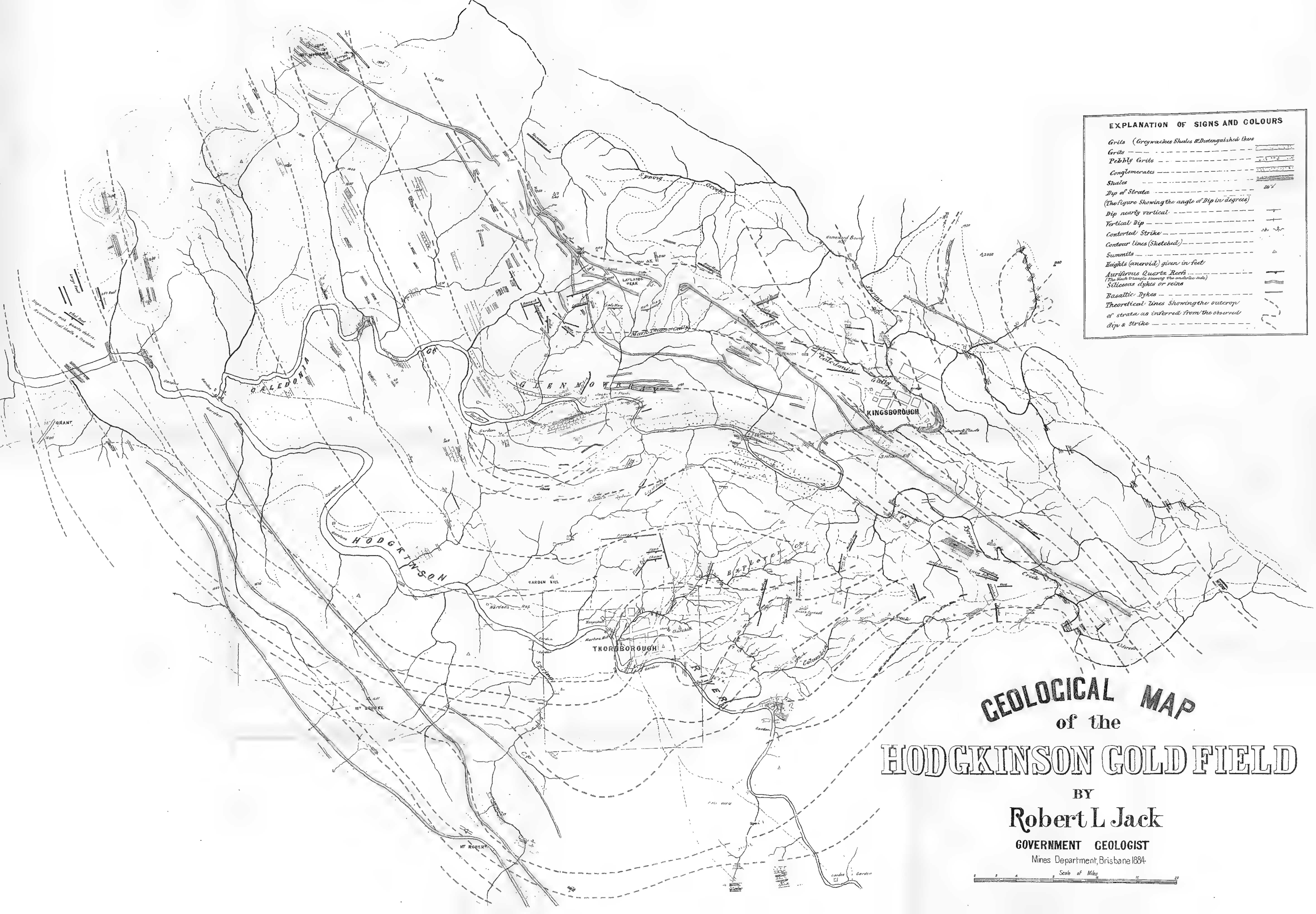
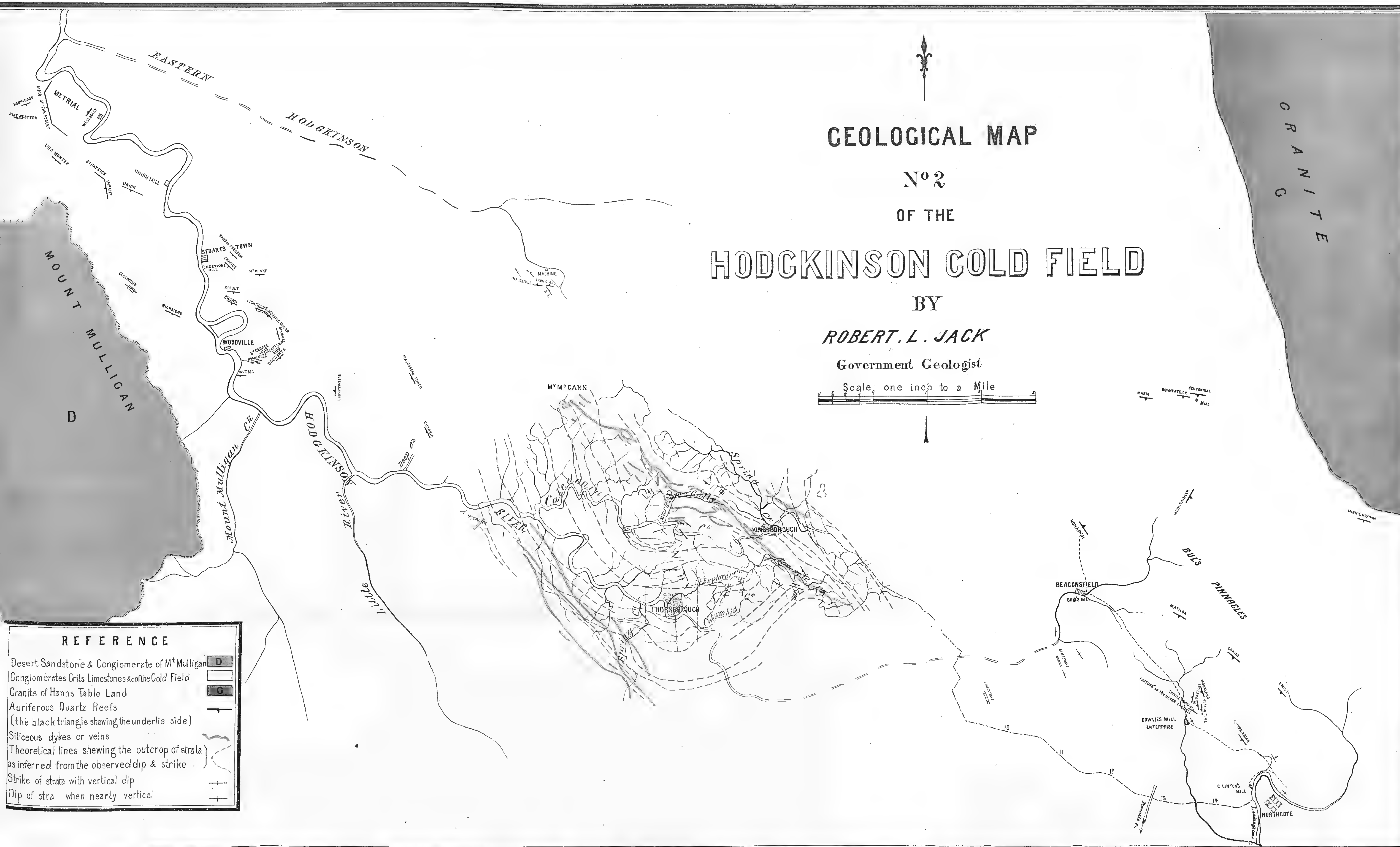



EXPLANATION OF SIGNS AND COLOURS
Grits (Greywackes Shales & Distinguished thus
Grits
Pebbly Grits
Conglomerates
Shales
Dip of Strata
80°
(The figure Showing the angle of Dip in degrees)
Dip nearly vertical
Vertical Dip
Contorted Strike
Contour lines (Sketched)
Summits
Heights (aneroid) given in feet
Auriferous Quartz Reefs
(The black triangle shewing the underlie side)
Siliceous dykes or veins
Basaltic Dykes
Theoretical lines Showing the outcrop of strata as inferred from the observed dip & Strike
KINGSBOROUGH
THORNBOROUGH
HODGKINSON
RIVER
CALEDONIA
GLENMOWBRAY
LAYLANDS PEAK
YARDEN HILL
Spring Creek
Caledonia Gully
GEOLOGICAL MAP
of the
HODGKINSON GOLD FIELD
BY
Robert L Jack
GOVERNMENT GEOLOGIST
Mines Department, Brisbane 1884
Scale of Miles



GEOLOGICAL MAP
Nº 2
OF THE
HODGKINSON GOLD FIELD
BY
ROBERT. L. JACK
Government Geologist
Scale, one inch to a Mile
REFERENCE
Desert Sandstone & Conglomerate of Mt Mulligan D
Conglomerates Grits Limestones &c of the Gold Field
Granite of Hanns Table Land G
Auriferous Quartz Reefs
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Strike of strata with vertical dip
Dip of stra when nearly vertical
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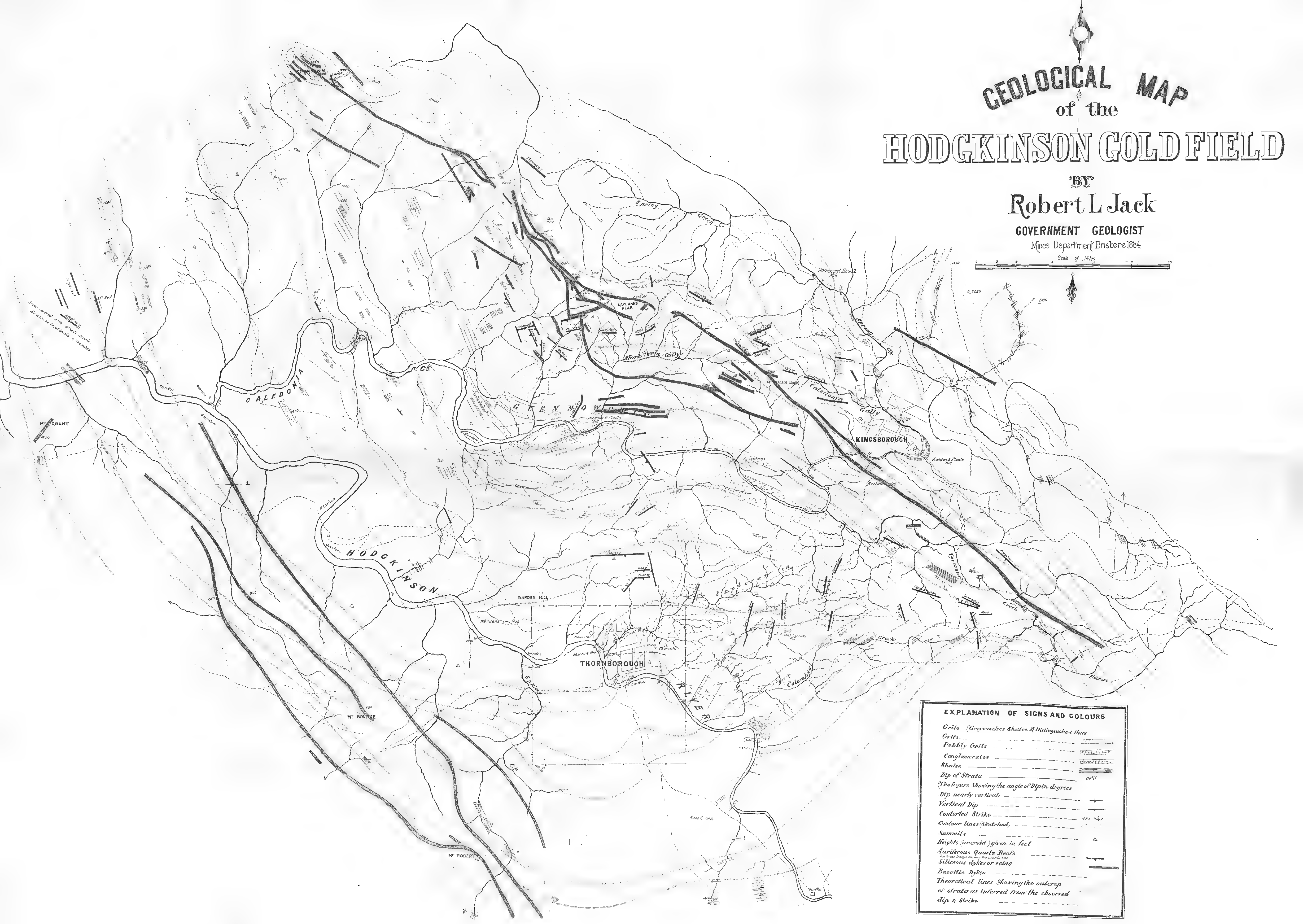
HODGKINSON
MOUNT MULLIGAN
D
GRANITE
G
Mt TRIAL
WELLESLEY
LOLA MONTEZ
UNION MILL
UNION
INFANT
STUARTS TOWN
Mt BLAKE
RICHMOND
CROWN
WOODVILLE
W. TELL
MACHINE
INFLEXIBLE
Mt Mc CANN
Mount Mulligan Ck
HODGKINSON
River
Little
Deep Ck
VICTORIA
RIVER
Caledonia
Spring Ck
KINGSBOROUGH
THORNBOROUGH
Explorer Ck
Columbia Ck
MARIA
DOWNPATRICK
CENTENNIAL
MINNIE MOXHAM
MONARCH
MOUNTAINEER
BULL'S PINNACLES
BEACONSFIELD
BULL'S MILL
MATILDA
CRAIGS
EMILY
DOWNIES MILL
ENTERPRISE
C LINTON'S MILL
NORTHCOTE
10
11
12
13
14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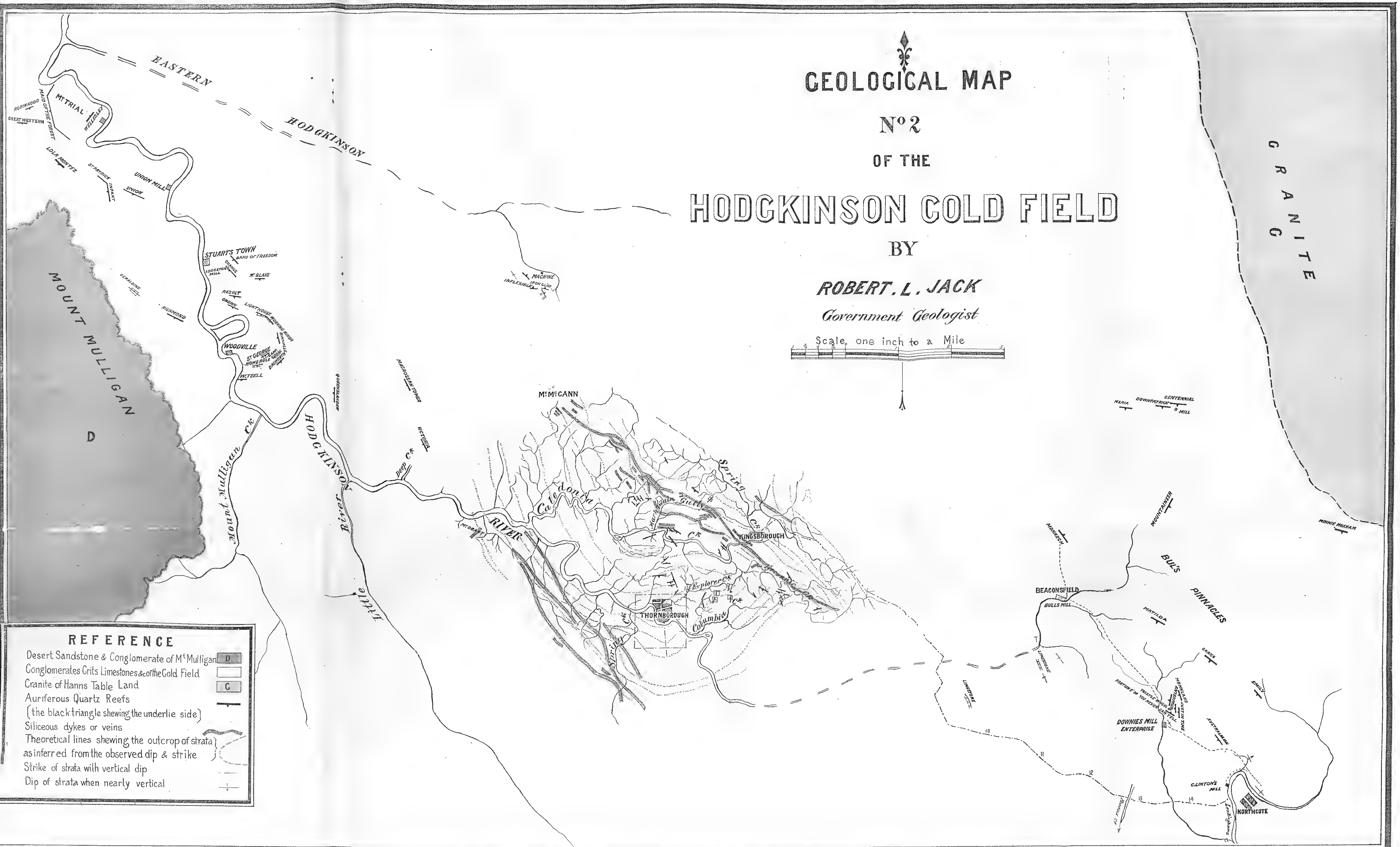
Spring Creek
Mark Twain Gully
Caledonia Gully
KINGSBOROUGH
CALEDONIA CK
HODGKINSON
WARDEN HILL
THORNBOROUGH
RIVER
Explorer Ck
Columbia
Creek
Eldorado
MT GRANT
MT BOURKE
MT ROBERT
MT MCCANN
Jackson & Plants Mill
Homeward Bound Mill



GEOLOGICAL MAP
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OF THE
HODGKINSON GOLD FIELD
BY
ROBERT. L. JACK
Government Geologist
Scale, one inch to a Mile
REFERENCE
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D
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ROBINHOOD
MAID OF THE FOREST
GREAT WESTERN
LOLA MONTEZ
ST PATRICK
INFANT
UNION
UNION MILL
STUART'S TOWN
BAND OF FREEDOM
LODESTONE MILL
CHANCE
Mt BLAKE
GERALDINE
RESULT
GROWN
RICHMOND
LIGHTHOUSE
WORKING MINER
WOODVILLE
ST GEORGE
HOME RULE
W. TEELL
MACHINE
INFLEXIBLE
IRON CLAD
QUEENSLANDER
MACROSSAN TOWER
VICTORIA
Mt McCANN
Mount Mulligan Ck
HODGKINSON River
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RIVER
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Spring Ck
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Explorer Ck
Columbia Ck
THORNBOROUGH
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BEACONSFIELD
BULLS MILL
BUL'S PINNACLES
MONARCH
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MARIA
DOWNPATRICK
CENTENNIAL
B MILL
MINNIE MOXHAM
MATILDA
LIMESTONE
GRACE
EMILY
DOWNIES MILL
ENTERPRISE
AUSTRALIAN
CLINTON'S MILL
NORTHCOTE
10
11
12
13
14

REPORT

ON

MOUNT MORGAN GOLD DEPOSITS

BY

ROBERT L. JACK,

GOVERNMENT GEOLOGIST.

(*Reprinted for the Mount Morgan Gold Mining Company, Limited, from an Official Report "ordered by the Legislative Assembly to be printed, 21st November, 1884."*)

Mount Morgan is not shown on the two-mile map of Port Curtis District, but it may be located on the western boundary line of the Selection numbered 247. This selection lies about twenty-two miles S.S.W. of Rockhampton, and near the head of Dee Creek, a tributary of the Dawson River. [*See Map attached hereto.*]

For the first twelve miles after leaving Rockhampton a low alluvial country is traversed. Out of the alluvial clay there rise here and there isolated mounds and ridges of greywackes and shales, both hardened, the latter sometimes into lydian stone and ribbon jasper, but not otherwise greatly altered. Although no limestones are seen on the road to Mount Morgan, the formation abounds in limestone beds, which may yet yield fossils to determine its age, but at present have only afforded some encrinites and corals resembling the genus *Heliolites*. There is, in fact, no sufficient evidence of the age of the deposit, but it is certainly palæozoic.*

About twelve miles from Rockhampton, on the heads of Gracemere Creek, granite is seen in a gully. It is soft and decomposing, and is covered with boulders of a coarse ferruginous siliceous grit.

Some five miles further is the Razorback Range, a sharp "pinch" on the road leading up to a table-land which stands about 900 feet above the sea level. The rocks seen on the road are metamorphosed strata, possibly belonging to the same formation which presents itself in a less altered form on the northern side of the granite. Similar country prevails till, in five miles more, Mount Morgan is reached.

In the immediate neighbourhood of Mount Morgan the "country rock" consists mainly of bluish-grey quartzite—a fine-grained siliceous sandstone, now more or less vitrified—full of minute crystals of iron pyrites and specks of magnetic iron ore†; greywackes of the ordinary type—hard fine-grained sandstones or mingled siliceous and felspathic materials now somewhat indurated; and, lastly, occasional masses of shale hardened to a flinty consistency, and a few belts of serpentine. As the stratified rocks in this particular locality appear to have been in thick beds, and as their metamorphism has gone a considerable length, it is not easy to be certain of either dip or strike. The stratified rocks are moreover interrupted and intersected in every direction by dykes and other intrusive masses of dolerite (itself altered by the substitution of viridite for its augite or olivine), trachyte, and other igneous rocks, the intrusive masses apparently occupying as much space as the remnant of the original stratified formation itself.

This country rock is traversed by reefs of the ordinary description, as, for instance, the Golden Spur Reefs, and the Crow's Nest Reef (*see Map*), and the Mundic Reef (*see Plan*), all of which contain a pretty fair amount of gold.

Mount Morgan itself contains gold in a very unusual—I believe a quite unprecedented—formation. The form of the latter will be best understood by a reference to the Plan (*based on surveys by Mr. F. Byerley*) accompanying this Report.

Aneroid measurements give the altitude of Razorback as 900 feet; of Hall and Company's offices, near the No. 1 Machine, as 705 feet; and of Mount Morgan, as 1,225 feet above the sea level.

The mine, which is at the summit of the mountain, is approached by a rather steep road, but the difficulties of haulage are lessened by tipping the stone into a shoot, an expedient which reduces the actual descent by horse-power to something like 300 feet in a distance of about half-a-mile.‡

The work (apart from prospecting or exploring operations) is carried on in two quarries or faces. No. 1 cuts into the hill from a level of about 25 feet below the summit, and is designed simply to remove the top of the mountain for the purpose of passing it through the stampers. No. 2, or Magazine Quarry, presents the aspect of a "sidling" road cut out of a steep hill, and attacks the auriferous deposit at a level of about 100 feet below No. 1.

The central portion of the upper cutting is a large mass of brown hæmatite ironstone generally in great blocks (up to some tons in weight) with a stalactitic structure, as if the iron oxide had gradually filled up cavities left in the original deposit. The ironstone contains gold of extraordinary fineness, which, however, after a little practice, can be detected in almost every fresh fracture. The ironstone is more or less mixed with fine siliceous granules. Gradually to right and left of the central mass the silica more and more replaces the ironstone. It is a frothy, spongy, or cellular sinter, sometimes so light from the entanglement of air in its pores that it floats in water like pumice. Fine gold is disseminated throughout this siliceous deposit as well as in the ironstone. Near the west end of the cutting is a vertical dyke of kaolin mixed with fine siliceous granules, passing into pure kaolin, with some silicates of magnesia, including a fine variety of French chalk.

I selected a number of specimens as characteristic of the various deposits of the upper cutting. These, when assayed by Mr. Karl Staiger, City Analyst, Brisbane, gave the following result :—

No. 5.—Stalactitic brown hæmatite from middle of cutting, 6 oz. 11 dwts. gold per ton.

No. 6.—Siliceous sinter veined with quartz, 4 oz. 5 dwts. gold per ton.

No.

---

* Since the above was written, collections of fossils made by the late Mr. James Smith and others have proved the strata in question to belong to the "Gympie Formation," the lowest member of the Permo-Carboniferous group. See *Geology and Palæontology of Queensland and New Guinea*. By Robert L. Jack and Robert Etheridge, junr. Brisbane: By Authority; 1892, p. 598.—R. L. J.

† Subsequent tunnelling operations have proved that these quantities are frequently charged with more or less auriferous pyrites to a remarkable extent. Although large tracts of the pyritous quartzites are too poor to be workable, recent explorations at the level of the Grasstree Tunnel have disclosed a large body of pyritous quartzite assaying from half an ounce up to 174 ounces of gold per ton.—R. L. J.

‡ This method of transport has since been superseded by tramways (aërial and rail).—R. L. J.

No. 7.—A mixed mass of ironstone and silica from the level of the road, east of the dyke, 5 oz. 3 dwts. gold per ton.

No. 8.—Iron-stained siliceous sinter from west side of dyke, 10 oz. 14 dwts. gold per ton.

The lower or Magazine Face presents a sort of fan-like arrangement of its various materials. In the centre is a band (almost vertical) of brown hæmatite in large "bombs," with a mammilated botryoidal or sometimes reniform appearance (*i*). To the right (east) is a nearly vertical deposit of aluminous iron ochre (*h*), followed by a mass (still nearly vertical) of red hæmatite in large cellular bombs (*g*). To the east is a broad mass of loose iron-stained siliceous and aluminous material (*f*) which begins to lean eastward like the outer feathers of a fan. A great mass of loose earthy hæmatite (*e*), another of brown hæmatite weathering to iron-ochre (*d*), another of red earthy hæmatite (*c*), and another of brown hæmatite in large (ton) blocks (*b*), appear in succession as the cutting is followed to the east. The magazine (near the east end of the cutting) is excavated in a fine white siliceous earth, and the cutting ends with a mass of soft earthy aluminite. Beginning from the west side of the nearly vertical mass of brown hæmatite (*i*) first described, we pass in succession in going westward a band of yellow ochre (*j*), a broad belt of light siliceous sinter (*k*) iron-stained, and containing some angular fragments of the quartzite of the "country rock," a belt of similar siliceous sinter mixed with earthy red hæmatite (*l*), and finally a broad mass of loose siliceous sinter traversed by siliceous veins (*m*), and containing some angular fragments of the "country rock," the members of the series leaning more and more fan-fashion to the west as they recede from the central vertical bands. At the end of the cutting is a mass of magnesian and aluminous silicates, which is probably the prolongation of the dyke seen in the upper quarry. Mr. Lisle, the Manager, informed me that he had got "prospects" in every part of this cutting, with the exception of the siliceous earth at the Magazine. This was corroborated by my own observations. I ground and washed a great number of specimens (of my own selection) from both the upper and lower cutting, and from every variety of material, and was surprised and delighted with the prospects obtained, in most cases from stuff which miners would regard as most unpromising.

Mr. Staiger's assays of characteristic samples selected from the lower cutting, yielded gold as follows :—

No. 1.—Brown hæmatite (from *b*), 3 ozs, 6 dwts. per ton.
No. 2.—Red hæmatite (from *g*), 6 ozs. 16 dwts. per ton.
No. 3.—Aluminous rock from west of dyke. No gold.
No. 4.—Siliceous sinter from among the aluminous rock, 3 ozs. 15 dwts. per ton.

Down the hillsides to the north, west, and south, a similar deposit is everywhere met with—a frothy or spongy matrix, sometimes aluminous and sometimes siliceous, generally iron-stained, and occasionally associated with large masses of red and brown hæmatite, but gold has as yet only been obtained from a few places away from the hill-top, although naturally there has been vigorous prospecting (so far as possible in an unusually dry season), wherever the "formation" resembled that of Mount Morgan. Perhaps the deposit on the slopes is more aluminous and less siliceous, and contains less of iron oxides than on the hill-top, but these are the chief differences, and the formation has evidently one origin throughout.

After a careful study of the whole formation I have come to the conclusion that nothing but a thermal spring, in the open air, could have deposited the material under consideration. The frothy siliceous sinter agrees in every respect with the deposits of New Zealand and Iceland geysers, and of the still more wonderful hot springs of the Yellowstone National Park so graphically and scientifically described by Dr, A. C. Peale [Twelfth Annual Report of the United States Geological and Geographical Survey of the Territories, Part II., Section 2, "On the Thermal Springs of Yellowstone National Park." Washington: 1883.] The "frothy" and cavernous condition of the siliceous sinter of Mount Morgan may be accounted for by the escape of steam while the silica was yet (after the deposition on the evaporation of the water) in the gelatinous condition so frequently observed in the deposits of hot springs. The aluminous silicates represent the familiar outbursts and flows of mud. The iron oxide appears to have been deposited in some cases along with the silica and alumina, and in others to have been deposited later—its solvent fluid having been, as it were, injected into the interstices, vesicles, and caverns of the silica and alumina. In some cases it may have been originally pyrites, as it now and then occurs in cubical hollows. Calcareous sinter is very common in siliceous springs, and its absence from Mount Morgan must needs imply the local absence of limestones among the rocks from which the spring was fed. The silica would be found abundantly in the quartzites and the alumina in the shales and greywackes of the country in the neighbourhood, and possibly both silica and alumina may have come in part from a deep-seated underlying granite. The gold, and to some extent the iron, may have been dissolved out of the iron pyrites of such reefs as the "Mundic Reef" seen in Mundic Creek; the gold possibly by chlorine produced by the contact of hydrochloric acid, derived from the decomposition of chlorides, with manganese, which occurs sparingly in the form of pyrolusite along with the ironstone of Mount Morgan.

Allusion has already been made to the trachytic dykes which intersect the metamorphosed stratified rocks of the district.

The rock may be thus described :—A hard very fine-grained, almost compact, dark-grey felsitic matrix with numerous and large crystals of sanidine and a few granules or blebs of quartz. Fragments of hornblende crystals occur, but so rarely that the mineral must be regarded as accidental. No augite; no olivine.

Several of these dykes run from north-west to south-east through the area included in the plan; one runs from north-east to south-west through Mineral Selection No. 75, and still further west (beyond the limits of the plan) a large—probably intrusive—mass of rhyolite* occurs.

That the deposit left by the thermal spring is newer than the altered stratified rocks through which it has burst is obvious; and that it is even newer than the much later date when the rhyolite† dykes filled up fissures in the stratified rocks is proved by the fact that the dykes are clearly seen in some instances to be covered over by the siliceous, aluminous, and ferruginous deposits of the springs (see on the Plan the dyke in Mount Morgan South, and that crossing Mundic Creek near the south-west corner of Selection No. 247). But

* Read "trachyte."—R.L.J. † Read "doleritic and trachytic."—R.L.J.

But yet another circumstance helps us in our endeavour to ascertain the age of the outburst of the Mount Morgan hot spring. About a mile to the west of the "mountain" is a mass—apparently about 150 feet in thickness—of horizontally-bedded sandstone. (*See Map*). It rests apparently at this point on a mass of rhyolite,* but in other places it may be seen lying on the upturned edges of quartzite and greywacke strata, similar in character to those of the "country" around Mount Morgan. The base of this formation is a fine volcanic dust. The upper beds are coarsely gritty, and, for the most part, siliceous, varying from white to brown and red, and containing occasional pebbles of quartz and quartzite. I recognise in it, without hesitation, Daintree's "Desert Sandstone," which I have traced from Torres Straits to Maryborough, and which lies unconformably upon, and is, consequently, newer than the strata of the Western Downs. The latter present strong Cretaceous affinities.†

The base of the Desert Sandstone I should judge to be about 100 feet lower than the summit of Mount Morgan. The following diagram-section (figure 1) will elucidate the remarks which follow:—

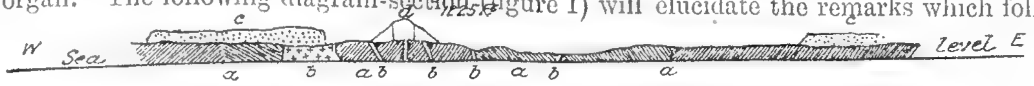


Fig. 1.—Diagram-Section on the line AB (see Map) across the Valley of the Dee.
Scale, half-an-inch to the Mile.

a, Metamorphic Rocks; *b*, Rhyolite,‡ &c., Dykes; *c*, Desert Sandstone; *d*, Thermal Spring Deposits of Mount Morgan.

Standing on the sandstone cliffs, so as to look to the east past the south side of Mount Morgan, the observer can descry across the valley of the Dee the familiar contour of horizontally-bedded sandstone cliffs stretching north and south. As nearly as can be judged by the eye, they are on the same level as the cliffs on the opposite side of the valley, and there can be no doubt that the valley has been carved out of a once-continuous cake of horizontal sandstone. The question arises, "Was Mount Morgan an island in the sea or lake in which the sandstones were laid down?" In that case the hot spring was older than the Desert Sandstone.

The answer is easily made. Had there been shores to this sea or lake where Mount Morgan now stands, the sandstone in the neighbourhood would have been full of pebbles of sinter and ironstone derived from the waste of such easily-degraded rocks. But I saw none such, and I believe they do not occur. The hot spring, then, was newer, and not older than the Desert Sandstone.

In many places in the North the valleys carved out of the Desert Sandstone became theatres of volcanic activity. Among such places are the MacIvor River, north of Cooktown, and the Mulgrave River near Cairns. These volcanoes burst out near the heads of the valleys and filled the lower reaches with flows of basaltic lava to which we owe some of the richest agricultural land in the colony. Another form of volcanic activity was developed at the same period near the head of the Dee Valley. After the Desert Sandstone had been uplifted, and the carving-out of the present valleys had been carried on for long ages—in fact, till the valleys had nearly acquired their present contours, basaltic lavas flowed down the valleys over the upturned slates of the MacIvor and over the auriferous drifts of the Mulgrave, and a geyser of enormous proportions spouted fitfully in the valley of the Dee, carrying with it not only water but in all probability chloride of gold.

The Mount Morgan geyser as well as the MacIvor and Mulgrave volcanoes probably date from Tertiary times, and are contemporaneous with many of the basalts which cover auriferous drifts in Victoria.

In the presence of so much ironstone a precipitant for the gold need not be far to seek. Protoxide of iron was probably present in sufficient quantities to perform this important function, but it may have been aided by tannic acid derived from vegetable matter accumulated in the basin. Several instances of the occurrence of vegetable matter in the basins of hot springs in the Yellowstone region are recorded in the report already quoted. Precipitation of the gold by means of tannic acid would accord better with the confinement of the gold to the basin or crater of Mount Morgan (to be afterwards alluded to) than precipitation by ferrous oxide.§

I have laid down on the map the limits of the overflow-deposit from the Geyser. It would be next to impossible, and I believe it would be useless, to map out the limits of siliceous sinter, aluminous deposit, and ironstone, merging as they do into one another by insensible gradations, and imperfectly exposed as they are on hillside and in gully. The outer boundary of the overflow-deposit is, in some places, ill-defined, as the "country-rock" is frequently impregnated with aluminous, siliceous, and ferruginous material, so as to be distinguishable with difficulty from the unmixed deposit. That the deposit does not extend far to the east of Mount Morgan is owing simply to denudation, the deposit having been removed from the steep slope of the hill on that side.‖

In such active geysers as are accessible to observation, we find a narrow pipe or fissure, terminating upward in a crater-like cup or basin. The Great Iceland Geyser, for example, has a pipe 12 feet in diameter, which has been sounded to a depth of 70 feet. I have seen no satisfactory explanation of the necessity for a cup, nor can I suggest one, but all the same the repeated occurrence of the cup evidently takes place in obedience to some natural law. It may be taken for granted that the Mount Morgan geyser was no exception to the rule, and I believe that that upper portion of the mount where ironstone predominates, and to which gold is almost confined, represents a basin occasionally filled with a fluid, in

* Read "altered dolerite."—R.L.J. ‡ Read "Dolerite."—R.L.J.

† The Desert Sandstone and Rolling Downs Formations are now classed as Upper and Lower Cretaceous respectively.—R.L.J.

§ In May, 1893, a stream of water containing 16·911 per cent. of $Fe\,SO_4$ = 30·93 per cent. of green vitriol ($Fe\,SO_4 + 7\,H_2\,O$), and estimated at 1800 gallons per hour, was tapped in the Linda Tunnel. This proves that the pyrites in the country-rock is capable of yielding one of the best-known precipitants of gold. The analysis was made by Mr. H. Leipner.—R.L.J.

‖ In my "Second Report" in 1888, I recognised that the supposed "overflow deposit" consisted of altered and weathered portions of the country-rock.—R.L.J.

in which silica, iron, alumina, manganese, and gold were held in solution, to be deposited when the bulk of the water from time to time withdrew into the pipe or the subterranean reservoirs with which the pipe communicated. The overflow of the ejected fluid left a siliceous, aluminous, and ferruginous deposit on the slope of the hillside, but the gold does not appear to have been deposited to any extent beyond the limits of the basin. It may be remarked that "prospects" of gold have been obtained in a few localities in the overflow-deposit. In such cases it may be a question whether the gold was carried down with the overflow, or whether it emanated from some of the subsidiary springs, which in such cases, as our experience of active geysers has shown, are pretty sure to break out in the vicinity of the main outflow. "Callan's Knob," for instance, is suggestive of one of these smaller springs.

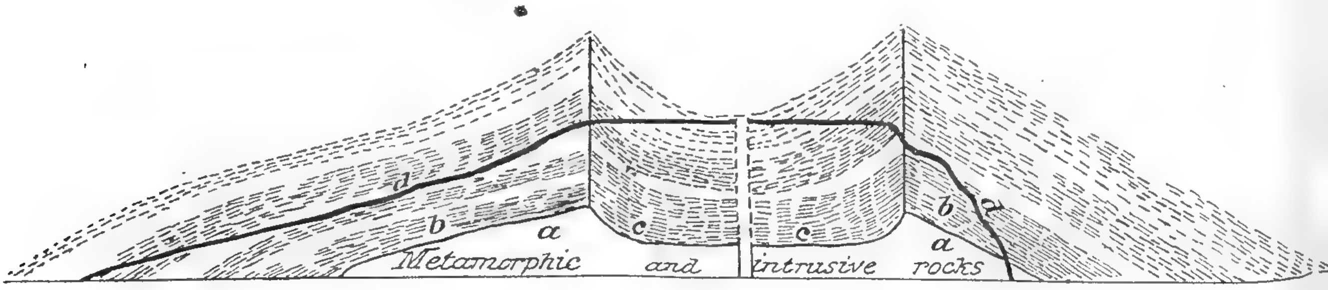


Fig. 2.—Diagram-Section shewing the building-up of Geyser Deposits and subsequent Denudation.

The above diagram-section (figure 2) represents my idea of what would take place in the case of a geyser remaining in activity for a, geologically-speaking, lengthened period. The original form of the ground may be taken to have been the line (*aa*). At the end of an outburst the sides of the hill would be covered by a deposit of precipitated material (*bb*), while on the recession of the water from the cup a film or layer of solid material (*cc*) would be deposited on its sides and bottom. If we suppose the cup to be a necessity arising from the operation of a natural law, as it seems to be, the continued action of the geyser must result in the building-up of a cylindrical cup-deposit, surrounded by an overflow-deposit, resembling a series of cased saucers placed upside down, and with the bottoms knocked out. Whether the different physical and chemical conditions under which the solvent in the cup and that which overflowed precipitated their solid materials is sufficient to account for the presence of gold in the one deposit and its absence (or scarcity) in the other, is a question which I leave to chemists. As a matter of fact this appears to have been the case in Mount Morgan.

After the cessation of thermal activity, the powers of subaerial denudation would come into play and might carve down the hill till the line *dd* should represent the surface contour of to-day. Such, I believe, is the history of Mount Morgan as we now see it. Denudation would obliterate the lateral terraces which are so familiar a feature in the scenery of every important geyser district in New Zealand and the Yellowstone, and which were probably not absent from the slopes of Mount Morgan. Mud-puffs and other evidences of the outbreak of hot water and gases from minor vents would be removed by the same process.

I have drawn a line on the plan to denote the limits of the auriferous cup formation. Considering the similarity of the deposit within and outside the cup, this line does not pretend to be more than an approximation to the truth.

Can any idea be formed as to the amount of gold to be obtained from the cup of the Mount Morgan geyser? I fear that as every item of the calculation would have to be preceded by an *if*, the answer would be of little value. The sectional area of the cup deposit is only approximately known. The depth of the cup deposit is not known at all, further than that it must be less than the difference between the levels of the summit of the hill and the bottom of the Dee Valley. Lastly, the distribution of the gold throughout the whole of the cup deposit is a pure assumption, in making which we are not assisted by a knowledge of any analagous case in nature. But the amount of auriferous stone at present in sight is enormous, and there is no rashness in believing that it extends over a large area and to a considerable depth. The following section (figure 3) shows the structure of the mountain:—

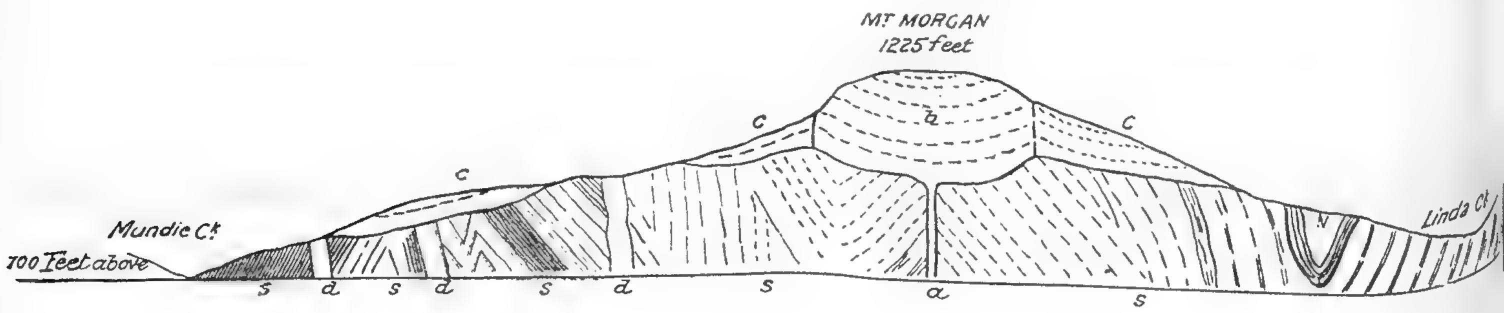


Fig. 3.—Section across Mount Morgan on the line AB (see Plan).

a, Pipe of Geyser (theoretical); *b*, Cup-deposit of Geyser; *c*, Overflow-deposit of Geyser; *s*, Metamorphic Rocks; *d*, Rhyolite* Dykes.

The Company have twenty-five head of stamps erected, although only five head were at work at the date of my visit. Water was very scarce, and it was evident that operations even on that limited scale might soon have to be suspended. In the meantime provision is being made for the storage of an abundant supply of water, so that the crushing may be carried on in an adequate manner after next wet season. Chlorination works are also being tried. No returns of crushings have been made, and therefore I am unable to

* For "Rhyolite" read "Dolerite."—R.L.J.

to give an average return. Mr. J. W. Hall estimated the stone awaiting crushing to contain on an average 10 ounces of gold to the ton. Whether this is a fair estimate I cannot say, but I satisfied myself from numerous test-prospects that the gold-contents were very good: I should judge over rather than under the average of Mr Staiger's assays. It is obvious that, when gold is so exceedingly fine as that of Mount Morgan, a large proportion of it cannot be saved by the ordinary process, as many of the fine particles will not settle during the brief rush of the water over the mercury. For the new dry amalgamation process, which claims to secure absolute contact of every particle of ore and gold with the mercury, I cannot help thinking that the finely-divided gold of Mount Morgan, sure to be wasted by any water process, offers a crucial test. I do not, however, propose to enter into the subject of gold-saving in this particular case, which has already been done by an eminent authority. Dr. Leibius, Chief Assayer of the Sydney Mint, has contributed a paper on Mount Morgan to the Royal Society of New South Wales (2nd July, 1884). I cannot do better than quote some of his observations :—

"While from a geological point of view the occurrence of this gold is highly interesting, the "character of the gold obtained is not less so. Lock, in his work on gold, published in 1882, says :—'No "'gold has yet been found in nature unalloyed with silver.' Yet this gold from the Mount Morgan mine, "of which since February last already over 10,000 ounces have been received as retorted gold at the "Sydney Mint, is found to be free from silver—a minute trace excepted. I have brought some of this "retorted gold rolled out very thin to shew its toughness. It assays 99·7 per cent. of gold; the rest is "copper with a trace of iron. Gold assaying 99·7 per cent. is worth £4 4s. 8d. per oz. Gold from the "same mine received at the mint assayed as high as 99·8 per cent. It is, as far as I know, the richest "native gold hitherto found. * * * * * * A not less interesting "though less satisfactory fact is this—that only about half the gold is extracted by the ordinary "quartz-crushing and amalgamating machinery.' Dr. Leibius continues 'The *Capricornian* says :— "'The tailings which are being stored are said to contain as much gold as is saved, and as they will be "'subjected to treatment at a future date the result will be highly advantageous to the owners.' Having "the small quartz-crushing machinery erected at the Sydney Mint under my charge I have had an "opportunity of testing this fact. In November last we received, through Mr. Hall, of Sydney, 458 lbs. "of this ferruginous quartz, part of it consisting of picked stone. It was carefully crushed and amalga- "mated in the Chilian mill with 240 lbs of mercury; thus 7·44 ozs. of gold, assaying 991·5, were "extracted. Another lot, weighing 174 lbs, was similarly treated, and 12·12 ozs. of gold extracted, "assaying 998·2. Thus lot 1 gave gold at the rate of 39·32 ozs. standard per ton of quartz; while lot 2 "gave gold at the rate of 169·86 standard per ton of quartz. In lot 1 gold at the rate of 46 ozs. 2 dwts. "12 grs. per ton was left in the tailings, while in lot 2 the tailings assayed 64 ozs. 5 dwts. 18 grs. of gold "per ton. Both lots of tailings were now mixed and passed for two hours in the Chilian mill "with 240 lbs. clean retorted mercury. Only 1·66 ozs. of gold, assaying ·981, were, however, "obtained by this treatment. The tailings were dried and found to weigh 476 lbs., containing gold at "the rate of 41 ozs. 13 dwts. 16 grs. per ton—or, in above 476 lbs. tailings, no less than 8 ozs. 17 dwts. "3 grs. gold. I have brought some of those tailings here. Under the microscope there is no gold "visible. I thought that if the oxide of iron were removed by boiling the tailings in hydrochloric acid "and the solution filtered off, the gold might more readily be discernible in the boiled-out residue. "I found, however, that this was not the case, and that 1,000 grs. of tailings thus boiled in strong "hydrochloric acid, by which about 20 per cent. were dissolved, gave me only 0·73 grs. of pure gold, "while 1,000 grs. of the original tailings, not boiled-out, gave 1·306 grains of gold, the same as when "boiled within nitric acid. The loss of gold by boiling in hydrochloric acid was, no doubt, due to the "action of this acid upon manganese in the ore, whereby chlorine gas was formed—a ready solvent for "gold. That the ordinary amalgamating Chilian mill did not extract all the gold in this stone I can only "attribute to the supposition that the oxide of iron has literally coated some of the fine gold, thus pre- "venting it coming in contact with the mercury."

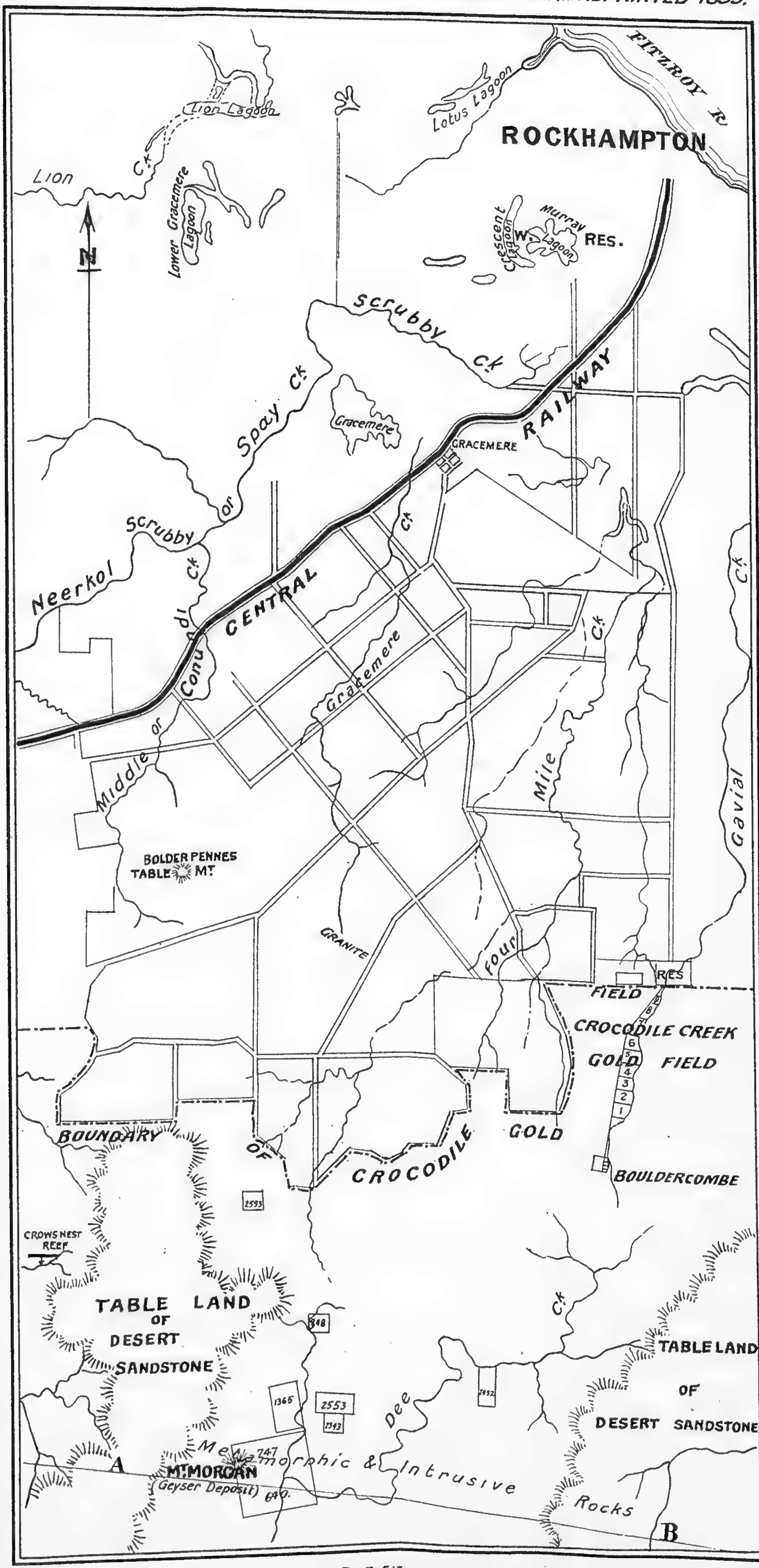
The discovery of gold in Mount Morgan is one of the most important events in the history of the mining industry. It is not merely that the quantity is large and that certain shareholders will be enriched; but the possibility that the discovery may lead to others of equal importance in a direction where gold has never hitherto been looked for lends it a wider significance. A vast area in our western interior is covered with Cretaceous rocks and has been covered with the Desert Sandstone, of which isolated tablelands remain to attest its former wide extension. Beneath the Cretaceous rocks Palæozoic rocks undoubtedly extend, and these doubtless contain many reefs as rich in gold as those which are exposed to view in the ranges near the coast. Given a hot spring rising from depths in which auriferous reefs lie hidden we may look for a repetition of the phenomena of Mount Morgan. My own acquaintance with the west has been limited, but I have long suspected that the opals and ironstones met with in certain western localities had something to do with hot springs. I have heard many tales of "craters" among the Desert Sandstone and Cretaceous regions of the west, and in some instances I suspect that my inform- ants may have been describing geyser deposits. I should look in such places now with a keener interest and with an eye to the chances of gold discovery. The subject will doubtless receive the earnest attention of prospectors. A few hot springs exist in Queensland at the present day, and several cases of "mud puffs" have been noted; but there is every reason to believe that the remains of extinct springs, dating, like Mount Morgan, from Tertiary times, may be widely distributed. I do not mean that the search for extinct hot springs should be confined to the western downs. My object is to point out that gold may yet be found over that enormous area where it has hitherto been regarded as hopelessly buried beneath Mesozoic and Tertiary accumulations.

ROBERT L. JACK.

Geological Survey Office,
Townsville, 8th November, 1884.

NOTE.—By the courtesy of the Secretary of the Mount Morgan Gold Mining Company, Limited, I have been allowed to "edit" this reprint of my original Report, and I have taken the opportunity of making, in foot-notes (without interfering with the text, beyond correcting misprints), a few corrections and additions, suggested by the experience acquired in the course of nine years' work in the mine. I did not see a proof of the Report as it originally appeared, having been at the time on duty "beyond postal communication."—ROBERT L. JACK.

MAP TO ACCOMPANY REPORT ON MOUNT MORGAN 1884. — REPRINTED 1893.



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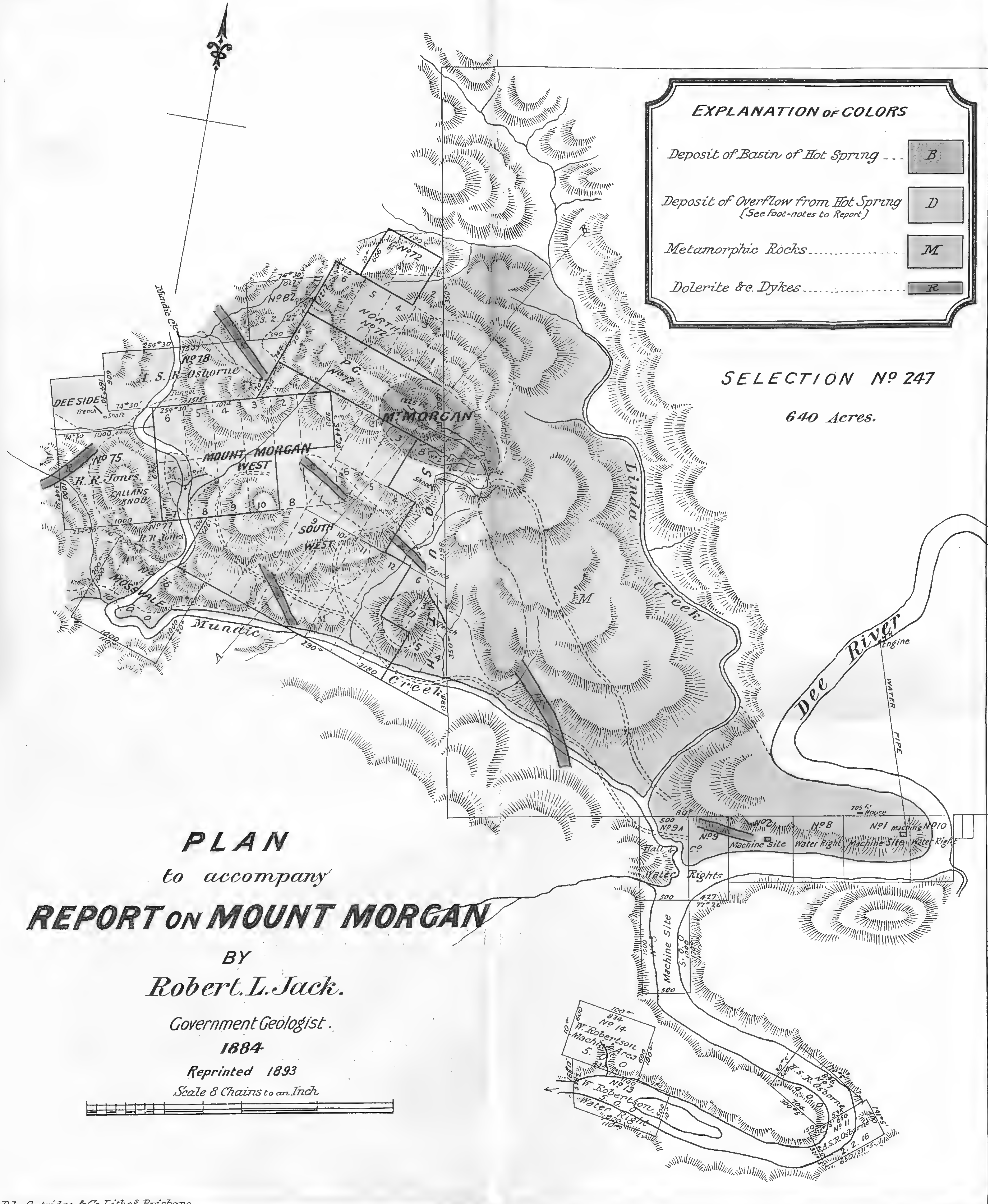

PLAN

to accompany

REPORT ON MOUNT MORGAN

BY

Robert. L. Jack.

Government Geologist.

1884

Reprinted 1893

Scale 8 Chains to an Inch

Pole, Ot.Pole, Outridge & Co. Lithoˢ. Brisbane.

1885.

QUEENSLAND.

REPORT ON THE GOLD DEPOSITS OF MOUNT LEYSHON, BY ROBERT L. JACK, GOVERNMENT GEOLOGIST.

Presented to both Houses of Parliament by Command.

The Pyramid or Seventy-mile Mountains are situated about sixteen miles to the south of Charters Towers, and rise abruptly out of a plateau of gray granite. A geological map of the district, based on a survey kindly made for my use by Mr. F. W. Mawe, Mining Surveyor, Charters Towers, accompanies this Report.

The granite is seen as far as the northern flanks of the Pyramid Range, where it is replaced by a porphyry, consisting mainly of straw-coloured silicated felspar, with crystals of orthoclase felspar and quartz, the latter occurring, however, most frequently in rounded blebs. A very few crystals of mica and hornblende occur, but they are so rare that neither mineral can be reckoned an essential constituent of the rock. South and west of the range, greywackes and slates are seen in the various creeks and gullies. There is nothing to show the age of the stratified formation, but the porphyry is newer than the latter, and is also newer than the grey granite, as it sends out veins or dykes into both. It is intrusive in its origin—*i.e.*, it was not upheaved into its present position, but was, while in a molten or viscous condition, forced by its own expansion, and the pressure of superincumbent rocks, into lines or rather planes of weakness, one of which was found at the junction of the granite and slate.

This weak part of the earth's crust was afterwards the scene of volcanic action on a very large scale. What now remains to us is not indeed the crater or lava of a superficial volcanic outburst, but the once deep-seated pipe or neck, or core, filled up with the fragmental material which supplied the ashy outbursts. It is entirely without stratification, or even the rude bedding characteristic of materials deposited in the open air, where the winds can winnow and separate layers of coarser and finer dust. Denudation has now removed, at least from the immediate neighbourhood, all trace of the ash and lava beds which, without doubt, once surrounded the orifice, and has laid bare the nuclei of the eruption, which stand up as hills in consequence of their toughness and superior power of resisting denudation.

The culminating point of the range is named Mount Leyshon. It stands 1,900 feet above the sea-level (aneroid measurement),* and 550 feet above the level of the camp at the foot of the hill.

The material of which the mountain is composed bears a resemblance in parts to porphyry, from which, however, it is distinguishable by the different manner in which it weathers; it varies considerably in texture, some portions being merely aggregations of fine gray or buff-coloured felspathic dust, while other parts are agglomerates of coarse angular débris of broken porphyry, cemented together by a sparse matrix of dust felted with iron oxide. Broken crystals and rounded blebs of quartz are scattered throughout the matrix; in fact the material is exactly such as could be manufactured from the waste of the porphyry. The quartz crystals of the porphyry have suffered little change beyond attrition or fracture. Crystals of felspar in some cases appear to have been developed in the ash, so that, but for the granular and clastic appearance of the matrix, the resemblance to the adjacent porphyry rocks would be complete. Occasionally nests of small plates of talc are met with.

It would appear that the materials filling up the volcanic "neck" were sufficiently loose and incoherent to admit of the passage of water and acids coming up from below, and bearing with it much iron in solution. The weathering of the rock in various hues of red and yellow proves the matrix to be saturated with iron oxide, while the joints of the rock are filled with veins of iron glance or brown hæmatite. In places where the rock is made up of large angular fragments, the faces of the latter are covered with a coating of yellow iron ochre; such coatings are occasionally encrusted with a film of microscopic quartz crystals. On weathered surfaces, the holes from which quartz crystals have weathered out have frequently a coating of minute crystals of iron glance, or are simply filled with spots of earthy hæmatite. That the veins of red or brown hæmatite were originally pyrites, and have only lost their sulphur and become oxidised as the result of weathering, is evident from the frequent occurrence of the hæmatite in cubical hollows. In the finer portions of the rock, veins of quartz are not uncommon.

* The following aneroid measurements are given for the sake of reference:—

	Feet.
Broughton River at Price's Crossing ...	1,000
Camp at Mount Leyshon ...	1,450
Cornish Jim's tunnel ...	1,510
Foot of Skids ...	1,490
Top of Skids ...	1,610
New Tunnel (Mount Leyshon Co.) ...	1,620
Top of Bluff, above new tunnel ...	1,790
Knob at head of Cornish Jim's Gully ...	1,880
Summit of Mount Leyshon ...	1,900
New Tunnel (Extended Co.) ...	1,680

On

On the summit of the eastern hill large bodies of quartz are met with, the quartz being of a pale bluish tint, and associated with lumps of hæmatite iron ore and manganese oxide; the bluish tint is apparently due to the presence of numerous minute crystals of pyrites, magnetic iron ore, and possibly manganic oxide in a state of fine division.

Gold follows the ores of iron, in whatever form the latter may occur. In the hæmatite veins which form a network at and above Cornish Jim's tunnel, gold may easily be seen, and where it is not visible to the naked eye a crushed sample seldom fails to yield a "prospect." In such places gold is not absolutely wanting, even in the body of the rock, where the iron oxide is very sparingly present; but the quantity in the rock elsewhere than among the veins is trifling. Weathered surfaces covered with a black glazed coating of brown hæmatite not unfrequently exhibit handsome specimens of gold, as I have seen at the mouth of the Extended Company's tunnel, and on the hill top, near the western boundary of the Prospectors' tunnelling area. The films of yellow ochre which cover the angular blocks of the coarser agglomerate also contain gold. One block blown from the Extended Company's tunnel had a yellow ochreous surface of about two feet square, and was glittering with golden specks.

The surface has been stripped from a considerable space on the north side of the hill, and, in spite of the difficulty of obtaining water, has paid well for washing.

A tunnel was driven by "Cornish Jim," about 30 feet into the foot of the hill on the north side, about twelve years ago. It is said that the material extracted yielded 2 ozs. of gold to the ton. Ferruginous veins appear to have been followed. A small prospect of gold can be obtained from the débris in the tunnel. The walls and ends of the tunnel show a mass of aluminous and magnesian silicates, in a weathered condition, with sparse brown hæmatite and ochreous veins. The rock is full of roundish blebs of quartz, and is slightly copper-stained in places.

Two tunnelling areas are held at present by the Mount Leyshon and Mount Leyshon Extended Companies. The former occupies the ground to the east of a line running SSW., and nearly parallel with the head of Cornish Jim's Gully; and the latter an area to the west of the same line. The Mount Leyshon Company was first in the field, and is carrying on exploratory work with vigour. It commenced work in a quarry at the top of the skids. Here the rock, while similar on the whole to that of Jim's tunnel, is characterised by the occasional presence of magnesian silicates in "oolitic" concretions. I saw a little gold in some thready ironstone veins at this place, and could obtain a fair "prospect" from a crushed handful of stone, including a good deal of vein stuff. The stone away from the veins yielded a very small "prospect," but enough to prove that it was not destitute of gold. A trial crushing of 20 tons, taken partly from the top of the skids and partly from Cornish Jim's tunnel, yielded gold at the rate of 5 dwts. per ton.

A tunnel has recently been commenced by the same company at a somewhat higher level, beneath a bluff near the head of Cornish Jim's Gully. The material at the mouth of the tunnel is, or was originally, a rather fine-grained ash, but it is now traversed by numerous ironstone and quartz veins, and is permeated and coated (owing to weathering) with red and yellow iron oxides. The tunnel is designed to cut the vertical extension of a mass of quartz seen on the hill top, full of pyrites, and so studded with fine gold that hardly a chip of the stone does not show a little. This quartz is not a reef in the ordinary sense of the word, but there is no reason why it should not go down as a "pipe vein" at least to the level of the tunnel.

Another tunnel has been commenced by the "Extended" Company in a brecciated rock made up of angular fragments of porphyry felted together with finer débris of the same rock, the whole being cemented with yellow and red iron oxides and traversed by quartz veins. Fine specimens of gold have already been obtained (as above mentioned) from this tunnel, on faces covered with yellow iron ochre and brown hæmatite. I also saw gold in the bluff above the "Extended" Company's tunnel, in the knob at the head of Cornish Jim's Gully ("1,880 feet" on the map), and on the spur leading from this knob towards Mount Mawe.

The agglomerate of Mount Leyshon does not appear to be intersected by well-defined quartz reefs, as is the case with the adjacent porphyry. The Mount Leyshon volcano was of later date than the porphyry (of which its ejectamenta were mainly composed), and in all probability is also newer than the reefs in the porphyry country. These reefs probably supplied the gold now distributed among the ironstone veins of Mount Leyshon.

One of these reefs crosses Cornish Jim's Gully to the north of the camp. It runs E. 10° N., and underlies to S. 10° E. at 40°. It was worked at the west end by "Cornish Jim," and at the east by "Greasy Bill," both of whom are said to have done well out of it. Other reefs occur near the camp, and several are known in the porphyry country to the east.

Alluvial gold has been obtained in Cornish Jim's and Greasy Bill's Gullies, and indeed in the heads of all the streams which take their rise in Mount Leyshon. The amount is not ascertainable, as the gullies appear to have been worked chiefly by Chinese, who are, as a rule, reticent and unreliable as to their earnings; but judging from the extent of the workings (and considering that these can only be carried on during a small portion of the year owing to the scarcity of water) the yield must have been very considerable. Some of the gold, no doubt, came from the reefs in the porphyry country, but the bulk of it must have been derived from the Mount Leyshon agglomerate.

The Mount Leyshon "neck," besides the mount itself, includes a boomerang-shaped tail, which extends southward and westward till it terminates in what I have called, for convenience sake, "Wallaby Point."

To the east of Mount Leyshon is an isolated "neck," the highest point of which (1,780 feet) I have named Mount Mawe. I obtained gold from a red ironstone vein, containing some quartz and a good deal of pyrites, on the north-west flank of Mount Mawe, and from a mass of frothy red ironstone on the spur of Mount Mawe leading towards Mount Leyshon. On the eastern side of the "neck," where it comes in contact with the slate country, blocks of slate and greywacke are of frequent occurrence in the agglomerate. Considering that this "neck" is unquestionably the source of the gold which has been so extensively worked in the "Seventy-mile" alluvial diggings, I cannot help thinking that it is worthy of serious prospecting.

It

It may be remarked that a gully (distinguished as "Southern Gully"), draining the eastern side of Mount Leyshon and the western side of Mount Mawe, offers, in my opinion, as fair a prospect of successful alluvial digging as the "Seventy-mile" itself, and yet it has never been touched. The drift is certainly deeper than that of the "Seventy-mile," but the area of alluvium is more extensive.

As Mount Leyshon has been lately referred to as "another Mount Morgan," it may be well to point out that the latter is a geyser or hot-spring deposit, pure and simple, while the former is the deep-seated core of an ash-discharging volcano. Its resemblance to Mount Morgan consists in the fact that the (once) loose and incoherent materials in the core admitted of the upward passage of water and acids carrying iron, gold, manganese, and silica in solution, till the rock was saturated, and the fissures and joints filled up with veins.

From the fact that the red and brown hæmatite of the veins frequently fills cubical hollows, it may be inferred that as soon as the mining is carried in (either vertically or horizontally) beyond the reach of the influence of weathering, the veins will be found to be composed mainly of (auriferous) pyrites.

In arriving at the conclusion that the systematic exploration of Mount Leyshon (and I may add Mount Mawe) is justified by the apparent prospect of success, I have been influenced even more by the consideration that the gold obtained in the alluvial must have had its source in the mountains than by the amount of gold actually visible in the mountains themselves.

ROBERT L. JACK.

Geological Survey Office,
Townsville, 6th February, 1885.

Price 3*d*.]

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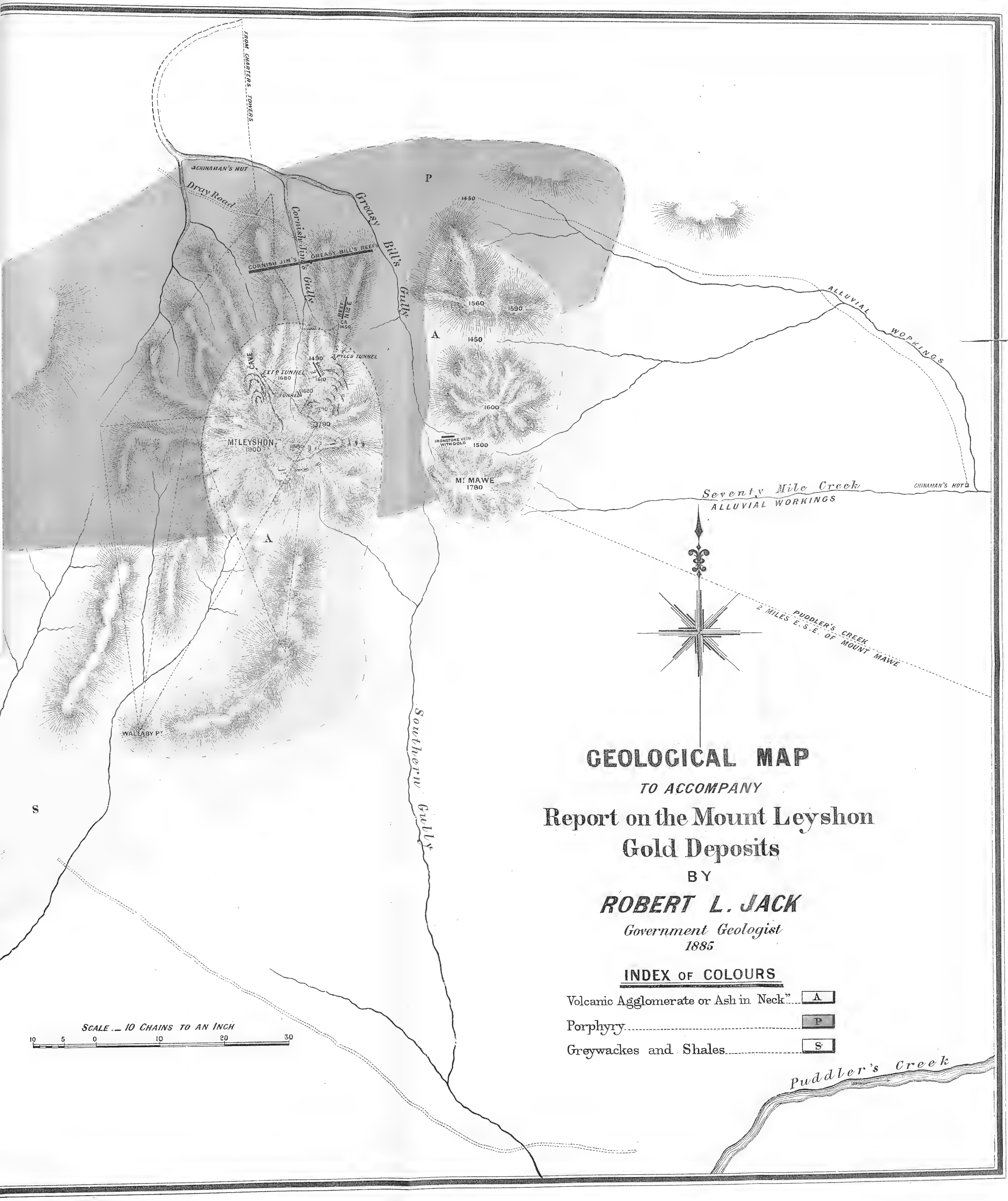
GEOLOGICAL MAP
TO ACCOMPANY
Report on the Mount Leyshon Gold Deposits
BY
ROBERT L. JACK
Government Geologist
1885
INDEX OF COLOURS
Volcanic Agglomerate or Ash in "Neck" A
Porphyry P
Greywackes and Shales S
SCALE _ 10 CHAINS TO AN INCH
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FROM CHARTERS TOWERS
CHINAMAN'S HUT
Dray Road
Greasy Bill's Gully
Cornish Jim's Gully
CORNISH JIM'S GREASY BILL'S REEFS
REEF N12 E
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Seventy Mile Creek
ALLUVIAL WORKINGS
PUDDLER'S CREEK 2 MILES E.S.E. OF MOUNT MAWE
Southern Gully
WALLABY Pt
Puddler's Creek

1886.

QUEENSLAND.

REPORT ON THE BURRUM COAL FIELD.

(BY THE ASSISTANT GOVERNMENT GEOLOGIST.)

Presented to both Houses of Parliament by Command.

The town of Howard, near the centre of the Burrum Coal Field, is situated about 18 miles north-east of Maryborough, and a mile west of the Burrum River, which flows north into the Pacific Ocean.

It is in this neighbourhood that the chief work of developing the field has been carried on. Considering, however, the number of years that the existence of coal-seams of workable thickness has been known, comparatively little has been done in that direction; nor does the completion and opening, two years ago, of the line of railway between Maryborough and Howard appear to have given such an impetus to mining enterprise in the district as might have been expected. This lack of enterprise is certainly not due to a want of a market for the products, for the demand for coal in the district is greater than the collieries now at work can meet; and coal is still being shipped to Maryborough from New South Wales. A continuation of the Howard line of railway to Bundaberg is now in course of construction. This line, over 40 miles in length, will pass for most of its distance over totally unexplored coal-measures, and besides opening up another market for the coal from the immediate neighbourhood of Howard, will undoubtedly act as a great incentive to the development of that portion of the field lying to the north of that place.

In the early days the coal was worked by means of drives, put in on the outcrops of the seams where they were exposed in the steep bank of the Burrum River. These drives were considerably below flood-mark, and hence the workings were always liable to be flooded; and, moreover, they acted as an easy means of access of the water to the seams, which, forcing its way between the planes of bedding, would naturally tend towards the weathering and deterioration of the coal. Many hundreds of tons were obtained from these drives, and were sent away in small schooners which could come up the river as far as the thick beds of sandstone which form the barrier on which the Maryborough and Bundaberg road crosses. The next step towards development appears to have been the sinking of a few shallow shafts from 50 to 100 feet in depth, beyond the reach of floods, but close, of course, to the outcrops of the seams. Among these were the Howard, Beaufort, and Whitley shafts on the western side of the river and Walsh's shaft on the eastern side. It is only of late, since the starting of the Company's and Torbanelea mines, that anything approaching true mining has gone on.

The country all through the district is remarkable for its flatness; in parts the principal watersheds even are scarcely recognisable. It is very thickly timbered with low stunted trees—chiefly wattle, grass-tree, tea-tree, honeysuckle, and bloodwood. The latter is usually employed in timbering the mines.

Accompanying this report are two maps. One, on the scale of 20 chains to 1 inch, comprises the whole area on which any work has been carried on, and shows the selections taken up. The other, on the scale of 2 miles to 1 inch, shows the positions of the outcrops of the various beds and seams of coal visible in the watercourses and other natural sections over the whole area traversed by me.

Overlying the coal-measures unconformably is a horizontal formation of far more recent date. Its lithological character varies very much in different places. In parts it consists of small particles and water-worn crystals of quartz cemented together with oxide of iron. In other parts it is a variegated red, white, and brown sandstone; while in others it is a very arenaceous clay, or loam, which in the neighbourhood of Salt-water Creek is used for brick-making purposes. This formation varies, too, from 15 to 40 or 50 feet in thickness, and overlying, as it does, the coal-measures, it is only where the rivers and creeks have cut deep channels through it that the underlying beds are exposed to view. There are, consequently, large tracts of country over which no information at all will be obtainable except by sinking or boring.

There is no evidence as to the exact age of this superficial deposit, for it contains, as far as I have been able to ascertain, no fossiliferous remains whatever; but from its lying undisturbed and in a horizontal position over so large an area, it must be of very recent date, and it probably belongs to the latter part of the tertiary period. It has, in places, much the appearance of having been thrown down as a loose coarse sand, the cementing materials having since been filtered in from above.

The next oldest rocks in the district are those which crop out at the town of Maryborough and are known as the "Maryborough beds." They have been quarried, about 1 mile west-north-west of the railway station, by the Corporation for road metal, and by the Government, 2 miles further out in the same direction, for railway ballast. The rock quarried is a fine-grained light-brown or grey sandstone. These beds contain numerous shells, which have been named by Mr. R. Etheridge, F.R.S.,* and are considered by him to belong to the cretaceous period, and to occupy a position between the Gordon Downs and Flinders River series, which are also referred to in the same paper. At

* Quart. Journ. Geol. Soc., London. Vol. xxviii. p. 283.

At the Corporation quarry the strata consist of light-coloured fine-grained sandstones, dipping 12 degrees to the north 35 degrees east.

About a mile and a-half further along the Gayndah road, and close to the River Mary, about half-a-mile from what is known as the Copenhagen Bend of the river, is the first of the Government quarries; the dip is about 7 degrees north 35 degrees east. The rocks showing are:—

	Ft.	in.
Broken sandstone...	8	0
Grey fine-grained sandstone (fossiliferous)	2	0
Band of laminated sandstone	0	6
Grey sandstone (fossiliferous)	2	0
Band of laminated sandstone	0	8
Brown sandstone	6	0
Brown shaly sandstone	0	4
Greyish brown sandstone (fossiliferous)	7	6
Fine laminated grey shale	0	5
Grey sandstone (fossiliferous)	2	3
Shaly band...	0	4
Grey sandstone (fossiliferous)	4	0
Black shale...	0	10
Hard dark-grey laminated sandstone (fossiliferous)	2	4
Shale	0	2
Grey sandstone (fossiliferous)	1	9
Laminated argillaceous sandstone	0	8
Dark-grey sandstone	2	0
	41	9

A quarter of a mile further up, exposed in another quarry, dip 7 to 8 degrees north 35 degrees east, are:—

	Ft.	in.
Brown sandstone with band of carbonaceous shale	6	6
Black carbonaceous arenaceous shales (fossiliferous)...	2	7
Soft yellow sandstone	6	2
Shale and soft carbonaceous sandstone	8	0
Coarse gritty sandstone	10	0
	33	3

Just a couple of hundred yards on the Maryborough side of the Copenhagen Bend, in a quarry, are showing 30 feet of grey sandstones, containing the ordinary fossils met with in these beds and also numerous hollow casts of belemnites; below this is a thin bed of carbonaceous sandstone, and below this again 50 feet of brown and grey sandstones (fossiliferous); dip, 9 degrees north 35 degrees east. Just in the centre of the bend, in a small gully cut into the steep bank of the river, are exposed:—

	Ft.	in.	
Horizontal sandstone, consisting of small quartz crystals cemented together	16	0	
Soft argillaceous sandstone...	9	0	Dip, 9 degrees north 35 degrees east.
Soft yellow sandstone	11	0	
Grey shale and nodular carbonaceous sandstone	10	0	
Black shales with bands of brown and grey sandstone	11	0	
	57	0	

These beds, it will be noticed, dip in the same direction and have about the same angle of inclination as the coal-bearing beds of Saltwater Creek and the Burrum River; and as they are not seen again beyond this point, it is probable that there is a fault between them and the Burrum series. Similar sandstones, too, with the characteristic fossils of the Maryborough beds (*Leda elongata*, *Avicula alata*, *Nucula quadrata*, and *Cyprina expansa*), are met with in the Isis River, about a quarter of a mile south-west of the Maryborough and Bundaberg road, with a dip of from 30 to 45 degrees to the east 40 degrees north; these beds, which overlie the coal strata, can be traced for about a mile up a gully running into the Isis about half-a-mile higher up, but are not met with in the river again.

I met with sandstones belonging to the same series containing the cretaceous fossils *Avicula alata*, *Leda elongata*, and *Nucula*, &c., &c., about 32 miles north-west of Bundaberg and about 10 miles south of Rosedale Station. Their dip was uncertain, but they were evidently overlying the coal-measure series which are exposed about 2 miles south in Litabella Creek, dipping 12 degrees to the north-east.

Next in descending order of time come the coal-bearing series of rocks. The coal-measures consist of a series of fresh-water sandstones, shales, mudstones, and nodular ironstones, with seams of coal dipping at angles varying from 8 or 9 up to 20 degrees, the average dip being about 11 or 12 degrees. These beds extend from the coast some 20 miles inland to near the heads of the Burrum and Isis Rivers, where, dipping at a high angle, they are altered into a series of micaceous schists, and finally rest upon granite. From just north of Maryborough they extend to north of the Gregory and Burnett Rivers. Coal, too, has been met with south of the Maryborough beds on the Tinana Creek, at Owanyilla, and near Miva. The longer axis of the coal measures, therefore, lies in a northerly direction. (Plan No. 7.)

With reference to the exact age of the Burrum Coal Field I am unable to speak definitely, for although there are numerous fossil plant remains, I found none very characteristic. Among those I found were species of *Sphenopteris*, *Pecopteris*, *Odontopteris*, and a species of *Cardiocarpon*.

Mr. Gregory, in his report on the field,* refers to the finding of *Glossopteris* above the upper or Beaufort seam of coal. I was unable to find *Glossopteris*. The presence of *Glossopteris* would undoubtedly be strong evidence of the palæozoic age of the beds, as it is generally associated with a palæozoic fauna.

From

* Report on the Burrum Coal Mines, by A. O. Gregory, Queensland, 1879.

From the shale about 2 feet above the seam of coal now being worked by the Queensland Colliery Company, some mollusca (*Zamellibranchiata*) were discovered. These, I believe, are the first fossil remains of a fauna that have been found in these beds, and I have sent them to Mr. R. Etheridge, junr., for his identification, and his report may throw some light on the question. I am of opinion, however, that the Burrum Coal Field will prove to belong to the mesozoic carbonaceous series.

In the course of the survey I traversed all the rivers, creeks, and gullies in the area comprised between the Gregory and Burrum Rivers, from the coast to their sources.

THE BURRUM RIVER.

The outcrops of the coal-measures can, in most instances, only be seen at or near the time of low water. In the lower reaches of the river no sections are visible.

In Watson's or Salt Creek are thin-bedded brown sandstones underlying blue shales, in which is a thin seam of coal. These shales contain very numerous plant remains; their dip appears in places to be a little south of east, and again, a little higher up, south-west, but it is not very distinct.

Several sections and outcrops of seams of coal are visible in Maria Creek, which runs through the township of Howard into the Burrum River about a mile north of the railway bridge. About a quarter of a mile from the Beaufort shaft, thick-bedded brown sandstone dipping to the east 35 degrees north 13 degrees. A quarter of a mile further along is another outcrop of sandstone. Again, about 10 chains further down is a thin seam of coal 4 inches thick, dipping 14 degrees east-north-east; immediately above it is dark-brown coaly shale, while below it is a thin band of fireclay.

Twelve chains lower down again, dipping 12 degrees to the east-north-east, are:—

	Ft.	in.
Alternative sandstone and shale	4	0
Shale with 2 inches of coal	0	11
Brown sandstone	4	2
Nodular ironstone	0	3
Shale (with fern impressions)	0	0
	9	4

One hundred yards further down a small shaft has been sunk on to a seam which, I am informed, was from 18 inches to 2 feet in thickness; a few tons of coal were taken from this shaft and also from a drive in the bank. In the creek are exposed:—

	Ft.	in.
Brown sandstone	0	0
Black carbonaceous shales	2	0
Alternate sandstone and shale	7	4
Coal	2	0
Fireclay	0	4
	11	8

Two hundred yards further along is a seam of coal, 2 inches thick, in brown carbonaceous shale.

Fifty yards further down are thick-bedded sandstones. From this point for the next 5 chains, the strata gradually bend round from dipping north-east to the north-west, and in the beds dipping north-west are two thin seams of coal.

	Ft.	in.
Conglomerate and sandstone	5	0
Blue shale	1	2
Sandstone	5	3
Coal	0	3
Shale...	1	3
Coal	0	4
Fireclay	0	3
Sandstone	0	0
	13	6

Immediately below this point, again, the rocks have their ordinary dip of 10 degrees east-north-east. A small fault seen in the bed of the creek accounts for this sudden change in the direction of dip. Nothing can be seen in the river between the mouth of Maria Creek and about 5 chains below the railway bridge, where a bed of thick-bedded coarse grey and brown carbonaceous sandstones (40 feet thick) form a bar across the river. Next, and underlying them, comes a thickness of softer sandstones and shales, and immediately underlying these is a seam of coal, which is now concealed by the mud; it was discovered in the western bank of the river in digging out a sunken punt. This seam was intersected when sinking the tubes in making the railway bridge. I could get no information as to its thickness. The dip of the strata here is 12 degrees east 37 north. What is probably the same seam is seen $3\frac{1}{2}$ chains above the bridge, where two seams of coal crop out in a small cutting in the eastern bank, which are known as the "Bridge seam." Of the underneath one only the top was visible. I am informed, however, that it is 3 feet thick. Above it are nearly 5 feet of black carbonaceous shales, and the upper seam 2 feet 7 inches thick, the whole of which can be plainly seen in the bank. Immediately overlying it are dark-brown shales. Three chains above this again, in a small steep gully in the bank, is a small seam of coal 3 inches thick underlying brown sandstone. From that point for the next 8 chains nothing can be seen in the river except a small outcrop of sandstone; here another steep gully enters the river in which two seams of coal are exposed to view—one a couple of inches thick, the other about 10 inches thick, in shales with thin bands of brown sandstone.

Five and a-quarter chains higher up, again, is the outcrop of the "Lapham or Torbanelea seam." Between the Bridge seam and the Lapham seam, therefore, there are about 220 feet of shales with a few thin beds of sandstone, and containing thin seams of coal. The small cutting in the bank by which this seam was reached is filled up. I was informed, however, that it was 2 feet thick, with a band of shale in the middle 4 inches thick.

Two

Two and three-quarter chains above, the "Burrum seam" crops out in the bank. This seam lies here about 35 feet below the Lapham or Torbanclea seam. It is 3 feet 7 inches thick and dips 12 degrees to the east 38 degrees north. This seam was originally worked by means of a drive put in on it from the river bank. Afterwards a shaft was put down by Mr. Walsh, about 80 yards from the river bank, to a depth of 40 feet. A tramway was laid from the shaft to the river and terminated in a "shoot," so that the coal could be shot at once on board the schooners. The shaft was situated too near the river which forms the boundary of Mr. Walsh's ground, and it was not sufficiently far to the dip of the coal, for it cut the seam right on its outcrop so that all the workings were to the dip. These workings have been closed for some time past. A borehole, put down 220 yards east 35 degrees south of the outcrop in the river, cut the seam at 64 feet. This seam and the Lapham and Bridge seams, as well as seams underlying these, have been traced by Mr. Robertson by means of boreholes for 2 miles in a south-easterly direction right into his ground. He put down a first series of 5 boreholes 1 mile to the south-east. The strata these boreholes (marked 1 to 5 on Map No. 1) passed through are given in the Appendix A attached to this report; it will be noticed that passing in their order from the dip to the rise, that first thick sandstones occur, then a seam of coal (probably the Bridge seam), then shales and thin beds of sandstone with thin seams of coal, and then again two seams 25 feet apart (the Lapham and Burrum seams); thus corresponding very closely with what was passed over in the bank of the river. Again, a little less than a mile further on in the same direction, a second series of boreholes, marked 6 to 12, were put down, in which the same order of strata occur and the same seams of coal are cut. Mr. Robertson's Torbanelea mine is on the Burrum and Lapham seams. I shall, however, have to refer to these workings further on.

Returning to the river, on the western bank, just opposite to Walsh's pit, a shaft (known as Joss's shaft) was sunk, and cut a seam of coal 2 feet thick at a depth of 70 feet; from the position which was pointed out to me, however, it ought to have passed through the Burrum seam long before it reached that depth, unless there were a fault here in the direction of the river. If there is a fault it can only be a small one, for otherwise the Watson and Hartley seams would not have been met with where they are in the boreholes above referred to. I could not get any very reliable information about this shaft either as to its exact position or what strata it passed through.

About 5 chains higher up the river, a thin seam of 10 inches is showing; and then again, 6 chains higher up still, the Watson seam of 4 feet of coal is plainly visible in the bank. A large quantity of coal was shipped away from this some years ago. This seam, too, was cut in one of the boreholes on Mr. Robertson's ground. The Watson seam lies about 152 feet below the Burrum.

Proceeding up the river, thick-bedded carbonaceous grey and brown sandstones, with a few beds of shale, are met with. These sandstones are seen in a small creek on the eastern side of the river, and again in the bend of the river, where the direction of both their outcrop and strike are coincident with the direction of the river. These sandstones, with their thin beds of shale, are about 400 feet thick. Near the top of these sandstones, in the western bank of the river, a seam of coal 18 inches thick, with a fireclay floor, dips 13 degrees to the east 40 degrees north. Twenty-seven feet below this is another seam, the total thickness of which cannot be seen. I was informed that it was 2 feet 6 inches thick; the thickness exposed to view is 16 inches. Fourteen feet of sandstones lie below this, and then comes the North Hartley seam, 4 feet 2 inches of coal without a band. This seam was worked for some time by means of a drive in the river bank; it is about 270 feet below Watson's seam. A borehole on the eastern side of the river cut this seam at 55 feet. A seam of coal 10 inches thick lies a few feet below the Hartley seam. Beneath this again are 200 feet of sandstone, still dipping 13 degrees east 40 degrees north, in which are three thin seams of coal of from 2 to 4 inches in thickness; these thin seams are exposed in a gully on the western side of the river; and then comes a seam which can be seen in the sandstone at the crossing of the Bundaberg road, situated near the base of this series of sandstones. This seam is here about 20 inches in thickness, and is probably the Glenesk, which has been worked about a mile and a-half from here in a north-westerly direction, where it is about 2 feet thick. I was unable to get any particulars as to what rocks were passed through in sinking the Glenesk shaft. (Plan No. 2.)

From this point, for a mile and a-half up the river, nothing is to be seen but, here and there, thick beds of sandstone which outcrop and form bars across the stream. Their positions are shown on the map. Their average dip is about 13 degrees to the north-east; they contain thin beds of shale and layers of nodular ironstone. Beds of shale and soft sandstone in all probability occupy most of those parts where no section is visible. In a gully in White's paddock sandstones crop out, and have been quarried for building purposes. A mile and a-half from the crossing, sandstone about 240 feet thick crops out.

At this point a small gully runs into the river on its western side, just above the southern boundary of White's selection, in which some seams of coal are exposed. The top one, about 4 chains from its mouth, is 4 inches thick and is overlaid with sandstone and shale. Below this come 40 feet of strata which cannot be seen, and then a seam of coal 1 foot 4 inches in thickness, on which a small tunnel has been driven; below this is 4 feet of clay and another seam of coal 1 foot 3 inches thick.

A quarter of a mile lower down the gully another seam of coal 1 foot thick outcrops in the bank; this seam has also been driven on.

For about three-quarters of a mile up the river from this point the only thing visible is the outcrop of a brown sandstone; then in a gully on the western side of the river a seam of coal is visible, in a waterhole, 7 inches thick; it is dipping 14 degrees to east 42 degrees north and overlies carbonaceous sandstones and thin shales; 3 chains higher up the gully are hard grey sandstones. Eight chains south-west of this a seam of coal is seen in a drive in the bank, some few yards from the river; it is 1 foot thick. This is close to the most southerly point of Map No. 1. As all the workings are included within the area comprised in this map, I will briefly describe them here before going on to a description of the structure of the other parts of the field.

TORBANELEA MINE.

On the eastern side of, and about 2 miles from, the Burrum River in a south-easterly direction is Mr. Robertson's Torbanelea mine. This is the only pit at work on this side, Walsh's pit having been abandoned some time ago. The pit, which is 10 feet by 5 feet, is sunk through the Lapham or Torbanelea seam down to the Burrum seam, cutting the former at 85 feet and the latter at 110 feet in depth. It is situated about a mile south-west of the railway, and a private line has been constructed to connect it therewith.

Work

Work was first started on the lower or Burrum seam, but it has been abandoned for the time being in order to work the Lapham seam, which is reached by a cross-cut put in from the former. The Lapham is a harder and better coal, especially for gas-making purposes. The Burrum seam here is 3 feet 11 inches thick with a band of shale 7 inches thick. (Plan No. 3.)

The roof is a grey shale and is fairly good. The coal is friable.

The Lapham seam is thicker and is a more solid and brighter coal. It is 6 feet 2 inches in thickness, including a band of black carbonaceous shale 1 foot 3 inches thick in the middle. It has therefore increased greatly in size from the place where it is seen in the river bank, where it was only 2 feet 4 inches thick, and it is, I learn, still increasing in thickness towards the south-east. (Plan No. 4.)

The roof is of black shale, with numerous shining slippery faces, known as "slickensides," which render it somewhat dangerous; and great care is necessary to prevent accidents from falls of the roof.

The average direction of the levels, or what may be taken as the direction of the strike of the seam, is north 37 degrees west; the dip varies from 1 in 4 near the outcrop, to 1 in 6 in the lowest levels. This high angle of dip is one of the drawbacks to the field, rendering the working more expensive, and also carrying the coal to a great depth in a comparatively short distance. The method of work is the "Pillar and Bord," the principal roadways being driven to the dip with the intention of working away the pillars to the rise.

The present shaft being to the rise of the workings, it is necessary to have two "lifts" both for the coal and for the water; and its being close to the boundary of the property the levels can only be advanced in one direction—viz., to the south-east. The mine has thus, up to the present, been worked under great disadvantages; but Mr. Robertson is now sinking a new shaft some distance to the dip of the present one, and in the middle of his property, which will enable him to develop the mine on a larger and more economical scale. The present output of the mine is about 800 tons a month.

Experiments conducted at Melbourne prove this to be a good steam-coal. Two tons of coal evaporated 3,900 gallons of water, whereas 2 tons of the best Newcastle coal (New South Wales) evaporated only 3,200 gallons of water, or in a ratio of $8\frac{3}{4}$ to $7\frac{1}{4}$. Complaints have been made as to the friability of this and other Burrum coals; but this is almost universally the case with seams of coal near their outcrop, and they will undoubtedly improve in this respect at lower depths.

THE QUEENSLAND COLLIERY COMPANY'S MINE.

This mine is situated on the other side of the river, about 50 chains slightly west of north of the Howard Railway Station. The shaft is 10 feet by 10 feet, and is 220 feet deep. In sinking it passed through several thin seams of coal, including one 2 feet thick at a depth of 63 feet. Particulars of the strata passed through in this shaft are given in the Appendix.

The seam being worked varies very much in thickness. (Plan No. 5.) The roof very bad. It is of shale with "slickensides." The floor is of fireclay.

The dip varies greatly both in amount and direction, from almost nothing up to as much as 1 in $3\frac{1}{2}$; the average being about 1 in 5 to east 34 north. The average strike of the seam being north 34 west.

The method of work has been the "Pillar and Bord." Mr. Rankin, the manager, is now trying the "long wall" system at the end of the north-westerly level, where the coal is 3 feet 6 inches without any band.

Several small faults have been met with. One in the north-westerly level runs in a north-east direction and displaces the seam 4 feet, the displacement increasing towards the dip. Another to the rise of the pit, out towards Whitley's shaft, runs in an easterly direction, the amount of down-throw of which is not known. The seams on this side of the river appear to be more disturbed than those on the south side; for several small faults were met with in Whitley's mine, and also in working the Beaufort seam.

The output is 1,500 tons per month. This will soon be greatly increased, as the levels, which were much too low to allow of a large output, are now being enlarged. The winding plant is a very fine one, and is equal to a very greatly increased output. As this and the Torbanelea mines are the only two at work, the output for field only reaches 2,300 tons per month.

WHITLEY'S SHAFT

is on the same seam as, and is 14 chains south 30 degrees west of the Company's shaft. The seam here was 6 feet thick with bands of shale, or about 3 feet 6 inches of coal. It was cut at 110 feet in depth, just in the middle of a small "trough" fault which displaced the coal about 34 feet and 6 feet (*see* sect. of fault, Plan No 6). A borehole, 5 chains off and $1\frac{1}{2}$ chains to the rise, cut the seam at 84 feet. The workings have been abandoned, the seam being now worked from the Company's shaft.

THE BEAUFORT AND HOWARD SHAFTS.

These were put down about a mile south-south-east of the Company's shaft to depths of 50 and 51 feet respectively, on what is called the Beaufort seam, which lies probably above the seam worked by the Company. It is 4 feet 5 inches thick with only a thin band of shale. This seam was also worked for some time by a tunnel driven in on the seam in the direction of its dip, and a large quantity of coal taken out.

A shaft called the "Briton shaft" was sunk 18 chains to the dip of these, with the intention of cutting this seam at a greater depth, but was abandoned at the depth of 320 feet. Allowing an average dip of 12 degrees, which is above the average rather than under, this seam ought to have been met with at a depth of just under 300 feet. It is probable, therefore, that there is a fault in a north-westerly direction accounting for the absence of the coal. A seam of coal 1 foot 6 inches thick was cut at 170 feet. Analyses of the coals from some of these seams are given in Appendix B.

THE

THE GLENESK MINE.

About a mile to the south-west of the Company's shaft, a shaft has been sunk 100 feet in depth on to a seam called the "Glenesk." The coal is from 18 inches to 2 feet in thickness. The country passed through in the shaft consists of hard grey and brown sandstones. The Glenesk seam is probably the same as that seen in the Burrum River at the crossing of the Bundaberg road, as it corresponds in direction with it, and that seam, too, is interbedded in grey and brown sandstones.

At present there is no sufficiently clear evidence to enable the various seams on either side of the river to be identified. Unfortunately, except in the case of the sinking of the Queensland Colliery Company's shaft, no records were kept of the strata passed through; and work having been stopped, the shafts of the other mines on this side of the river are full of water, preventing an examination of the seams.

The Company's seam has generally been considered to be identical with the Burrum seam, seen in the river bank. This can scarcely be the case, for the Lapham seam, which lies a few feet above the Burrum seam, would be missing It may, however, be the Lapham seam, and the thick series of shales with thin bands of sandstone and thin beds of coal would, to a certain extent, bear out this supposition.

Continuing up the Burrum River from the point where we left off, no section is met with till the junction of its branches—Stony Creek and Duckinwilla Creek—is reached. Here there are about 100 feet in thickness of alternative brown and grey sandstones and shales; the shales containing thin leaf-like layers of coal and also bands of clay ironstone. The dip is 12 degrees to east 42 degrees north.

Beyond this there is no section for some miles. At the junction of Powell's Creek with Stony Creek, black shales with thin bands of brown sandstone dip 9 degrees to north 20 degrees east. The overlying horizontal sandstone met with in the neighbourhood of the Burrum is about 30 feet thick here.

Following up Stony Creek, opposite Warrah paddock, there is a hardened altered sandstone dipping 35 degrees to north-east. A mile further up quartzite dips 40 degrees to the east. A mile further up again, just opposite Forbes's Creek, 3 feet of very hard brown sandstone overlies a soft yellow sandstone; dip, 30 degrees to east 30 degrees north.

In Forbes's Creek, 7 chains above the junction, a section of thin-bedded carbonaceous sandstones lies between massive hard grey sandstones; dip, 32 degrees to east 10 degrees north. A few yards further up, laminated shales dip 35 degrees to the north-east.

Half-a-mile further up Forbes's Creek very hard brown sandstones, with a bed of bluish shale 1 foot 6 inches thick, dip 35 degrees to north-east. Just beyond this point, and also in Stony Creek, quartzites occur abutting on a syenitic granite, which can be seen in both creeks.

In Lagbridge Creek very few sections are exposed. For about 3 miles below the road are hard altered sandstones with a dyke of felsite running nearly north and south. Above the Gayndah road the altered sandstones still continue, and they are in places very calcareous.

In Powell's Creek about a mile above Lower Doongul Station, in a small gully, dipping 40 degrees to north 35 degrees east, are seen:—

	Ft.	in.
Greenish micaceous sandstone	4	0
Fine-grained grey carbonaceous shale	1	5
Greenish and brown sandstone	2	8
Banded carbonaceous sandstone and nodular ironstone	1	6
	9	7

A quarter of a mile higher up this gully a hard flinty whitish sandstone dips 35 degrees to south 10 degrees west.

In a quarry half-a-mile further up, near the Gayndah road, are sandstones which have been quarried for road metal. This quarry shows 60 feet of whitish hard sandstones, argillaceous in parts, and with a band of grey shale 18 inches thick; dip, steeply to east-north-east. These sandstones, coloured red in parts by the infiltration of oxide of iron, as far as I could see, contained no fossils.

Immediately underlying these, and exposed in a cutting in the road, are:—

	Ft.	in.	
Grey shales with bands of brown sandstone	90	0	Dip, 45 degrees east-north-east.
Grey and whitish sandstones	177	0	
Break in section	24	0	
Carbonaceous shales with bands of sandstone	30	0	Dip. 40 degrees east-north-east.
Soft dark-coloured shales	3	0	
Hard greenish sandstone	12	0	
Break in section	60	0	
Sandstone with layers of shale	6	0	
Coarse grey sandstone	7	0	
Fine-grained laminated sandstone	7	0	
White argillaceous sandstone	8	0	
Blue carbonaceous and micaceous shales with thin bands of brown sandstone	16	0	Dip, 35 degrees east-north-east.
	438	0	

A mile further up Powell's Creek a calcareous sandstone dips east-north-east, and a quarter of a mile again dips 18 degrees to east-north-east. This sandstone is mottled red and white.

Immediately south of this point granite is met with

THE CHERWELL CREEK.

The Cherwell Creek is reached about 4 miles north-west of Howard. It runs in a north-easterly direction into the Burrum River. The country between Howard and the Cherwell is very flat, and being covered with the overlying sandstone formation, no information as to the structure of the country can be obtained.

Starting from a point about a mile above the crossing of the old Bundaberg road, a seam of coal was cut in sinking a well on the north side of the river. The thickness of this coal was never ascertained owing to the water rising so quickly in the well immediately the coal was struck.

On the opposite side of the river from this well a seam of good hard coal, of unascertained thickness, can be seen in the water. Large lumps can be detached. From their relative positions it is probable that this seam overlies the one that was discovered in sinking the well. Going

Going up the creek, brown sandstones are lying immediately underneath this seam. Dip, 6 degrees to east 30 degrees north.

Some half-a-mile further up the creek, at what is known as the lower crossing of the old Bundaberg road, grey and brown sandstones cross the creek, and dip very slightly to east 20 degrees north.

Just a quarter of a mile above this again, a seam of coal crops out in a waterhole.

Higher up again, at the upper crossing of the road, are sandstones lying quite flat.

For some distance, about a mile above this, no section is showing. Then in a waterhole is an outcrop of a seam of coal. It is covered with water, and its thickness is not known; but it must be at least a foot thick, as large cubical pieces, with sides of over a foot in length, have often been picked up.

About one-third of a mile further up, brown sandstone and a bed of ironstone dip to the south-west.

A quarter of a mile further up again, a small seam of coal 5 inches thick dips 11 degrees to the south-west; and 4 chains beyond this are black shales with very thin leaf-like layers of coal—dip, 13 degrees to south-west.

Passing across from the creek to a small branch creek, which runs in a north-easterly direction into the Cherwell a mile or so below this point: about a mile up this branch creek, yellow and grey thick-bedded carbonaceous sandstones outcrop in the bank, and are dipping 11 degrees to the south-west.

About half-a-mile further up this creek it divides into two branches, one of which—the left-hand one—forms a string of waterholes. In one of these waterholes, just above the junction, a seam of coal, said to be 2 feet thick, crops out, but only the surface of it was visible in the mud. A second seam of coal lying below this one, and 1 foot in thickness, in beds of dark-brown shales, can be seen in the right-hand branch just a few yards below its junction, dipping 11 degrees to south-west.

THE ISIS RIVER.

The Isis River runs east-north-east into the Burrum River, about 2 miles above the mouth of the Cherwell Creek.

At its junction with the Burrum are yellow sandstones.

For a mile and a-half no section is seen, and then in the south bank is a brown sandstone, the dip of which is uncertain.

A mile above this, where the river bends at right angles to the south-south-west, the dip of the sandstone is 8 degrees to east 20 degrees north. Just about 100 yards above this are carbonaceous sandstones lying very flat.

A mile beyond this are cliffs, about 40 or 50 feet high, of the horizontal sandstone formation on the south side of the river.

For some distance beyond this there is no section at all. Then 300 yards above the upper island, and three-quarters of a mile below the rafting ground, is a grey impure sandstone with layers of shale. Dip, 6 degrees to east 20 degrees north.

	Ft.	in.
Grey sandstone	4	0
Brown shales	3	0
Ironstone	0	3
Dark-brown carbonaceous shales	2	0
	9	3

A third of a mile below this a seam of coal 3 inches thick was cut in a shaft on the south side of the river at 15 feet in depth.

Half-a-mile above the last section a bed of grey sandstone crosses the river. Dip, 15 degrees to east 25 degrees north.

Ten chains again above this, at the boundary of the rafting ground, greenish-grey hard sandstone dips north-east; and immediately above this, about 100 yards, at the lower crossing of the old Bundaberg road, conglomerate, shale, and sandstone dip 9 degrees to west 20 degrees south.

A third of a mile further up the river is an outcrop of black carbonaceous shale and coal in the north bank. A borehole was put down to cut this. It consisted of black shale with thin leaf-like layers of coal, not the eighth of an inch in thickness.

A third of a mile higher up hard grey carbonaceous sandstones dip 10 degrees to the south-west.

A quarter of a mile higher again is a bed of grey sandstone crossing the river. Dip, south-west.

Sixteen chains higher up is a shale containing a large percentage of coal mixed with it in thin layers; and a chain above and overlying this is a grey carbonaceous sandstone. Dip, west 22 degrees south.

Thirteen chains above this again a bar of sandstone, extending 9 chains, with an average dip of 9 degrees to west 22 degrees south. This would represent a thickness of nearly 100 feet of sandstone.

A little over a mile higher up, dipping 18 degrees to west 20 degrees south, are:—

	Ft.	in.
Brown sandstone	6	6
Black shale	3	9
Brown sandstone	13	0
Brown shale	4	7
Grey carbonaceous sandstone	22	7
Coal	0	4
Black coaly shale	14	9
Brown sandstone	13	0
Coaly shale	3	9
Brown and grey sandstone	46	6
Grey shale	1	10
Brown shale	6	6
Brown sandstone and nodular ironstone	16	9
Brown sandstone with layers of shale	11	7
	165	6

About

About a mile and a-half above this, dipping 16 degrees to west 35 degrees south, are :—

	Ft.	in.
Greyish sandstone	2	10
Coal	0	2
Black and grey banded shale	1	0
Coal	0	1
Grey arenaceous shale	2	4
Coal	0	3
	6	8

A quarter of a mile above this is a banded sandstone and shale. Nothing more is visible in the river until after crossing the Bundaberg road, a distance of over 4 miles.

About a chain above the road, a brown sandstone dips 35 degrees to east 30 degrees north. This is seen again in the high bank 4 chains higher up.

About 15 chains further up are the fine-grained sandstones containing cretaceous fossils, already referred to in this report. They dip 50 degrees to east 40 degrees north, and are exposed to view for a quarter of a mile.

Half-a-mile above the road a gully runs in on the south side of the river. Six miles from its junction, a black fossiliferous shale dips 30 degrees to east 40 degrees north. For a mile up this gully sandstones and shales, containing cretaceous fossils, occur.

Two miles from here the Isis River branches into two creeks—Oakey Creek, and Agnes Vale or Broom's Creek.

A thin seam of coal is visible in a gully about a mile up Oakey Creek.

Half-a-mile up Broom's Creek, dipping 45 degrees to east-north-east, are alternate beds of brown sandstone and shales; and only a chain higher up, dipping 26 degrees to east 10 degrees north, are:—

	Ft.	in.
Alternate sandstones and shales	10	0
Coal (with a thin band of shale)	0	8
Sandstone and shales	50	0
	60	8

A mile further up a bed of coal 4 inches thick occurs in shale.

Close to the junction of Rocky Creek are thick-bedded brown sandstones. Dip, 20 degrees to the north-east.

A mile above this point, dipping 16 degrees to north 10 degrees west, a section 30 feet thick of alternate carbonaceous sandstone and shales, with a seam of coal 4 inches thick. In a waterhole only about 20 yards off the sandstones dip north 30 degrees east.

Following up the creek for the next 4 miles, very little can be seen with the exception of, here and there, hard altered sandstones, with conglomerate and shales, dipping steeply to the east or thereabouts. At this point a small area of about 4 square miles of granite is passed over.

The country to the west, and all the way up the creek, consists of highly inclined metamorphic rocks, consisting chiefly of micaceous slates and altered sandstones, with, in places, quartzite and gneiss. These rocks contain small rivulets of quartz. They mutually rest on granite.

Close to Agnes Vale Station, about half-a-mile to the south-west, is a reef or lode, on the cap of which there is copper-stained quartz.

Four miles below Agnes Vale Station are perpendicular dark-coloured micaceous slates.

A mile higher up the creek is a hard micaceous sandstone.

Half-a-mile again is a fine-grained brown sandstone.

Half-a-mile further up, a gneiss and micaceous slate.

Again half-a-mile, a dyke of granite crosses the creek in a direction a little north of west.

A mile above Agnes Vale, a quartz reef crosses the creek in a north-west direction.

Three-quarters of a mile above this, staurolite micaceous slate dips steeply north-east.

Half-a-mile higher up, gneiss quartzite and micaceous slate are seen dipping steeply north-east in the high bank of the creek.

Half-a-mile further up micaceous slate dips steeply to the east.

Just north of Broomfield an altered sandstone dips east; and from here to the summit of the range, the country is micaceous slate.

On the road from Agnes Vale to Stanton Harcourt, for 2½ miles, micaceous staurolite slates are passed over; dip, steeply to east. At this point the slates are bounded by the granite.

On the road from Agnes Vale to Doongul, a mile from the station, are whitish argillaceous and brown micaceous sandstones dipping steeply to the east 20 degrees north.

A mile-and-a-half further along, light-grey micaceous sandstone dips steeply west 25 degrees south.

In a road-cutting at the point where the Agnes Vale road joins the Gayndah road, white and brown sandstones with bands of grey shale dip steeply to east 15 degrees north.

About a mile further on, a thick-bedded brown and grey sandstone, containing numerous markings of the stems of plants, dips 55 degrees to west 20 degrees south. A quarry shows 30 feet of them.

A mile further along the road, mottled sandstones dip 50 degrees west 15 degrees south.

A little over a mile again, brown sandstone with blue shales dip 50 degrees to west 25 degrees south.

Half-a-mile further on are argillaceous sandstones.

One mile beyond this is a long cutting in the road on the top of the range. For the first 200 yards a hard sandstone, containing a small intrusive sheet of diorite, dips 60 degrees to the south-west. Beyond this to the end of the cutting, which is over half-a-mile long, fine-grained micaceous laminated sandstones dip from 55 to 60 degrees to the south-west.

Half-a-mile beyond this point the granite is met with again.

THE

THE GREGORY RIVER.

The Gregory River runs in an easterly direction into the Burrum River, which it joins about 3 miles above the mouth of the Isis. From the crossing of the Maryborough and Bundaberg road there is no section for over 3 miles. Just opposite Messrs. West and Blisset's sugar-mill a bed of black shale 16 inches thick, with a thin band of fireclay in the middle, is full of thin leaf-like layers of coal, and dips 14 degrees a little south of west.

Half-a-mile lower down in a waterhole, drift coal has been picked up in large blocks often over a cubic foot in size. This coal was of good quality, and for some time was carted away by a blacksmith for use in his forge. The exact position of the seam has not yet been found, as its outcrop is concealed by drift and mud.

A mile further down the river, dipping 15 degrees to west 20 degrees south, are:—

	Ft.	in.
Coarse brown sandstone	6	0
Fine-grained sandstone	0	6
Fireclay	0	2
Coaly shale	0	6
	7	2

A quarter of a mile lower down, where the present (private) coach road to Bundaberg crosses the river, there are thick beds of brown and grey carbonaceous sandstone, with bands of ironstone. Dip, 18 degrees to west 20 degrees south.

No section is visible for the next 6 miles. This is to a great extent due, I believe, to all the waterholes having been completely filled by a recent thunderstorm, and thus concealing outcrops of rock that otherwise would have been visible.

Six miles lower down very hard grey and brown carbonaceous sandstones dip 14 degrees to south-west. These sandstones form a series of bars across the river at low water, and are 400 feet thick.

A mile lower down again, below the junction of Stockyard Creek, two bars of similar coarse-grained sandstone dip 12 degrees to the south-west.

Following up Stockyard Creek near its mouth the same thick beds of sandstone, which were seen in the river, cross the creek. Dip, 10 degrees to west 40 degrees south.

Half-a-mile from its junction with the river, sandstone dips 10 degrees to west 25 degrees south.

No further sections could be seen in this creek with the exception of two places: the first, 4 miles from the town of Abington on the Bundaberg road, where sandstones, with a few badly preserved fern impressions, dip 10 degrees to the south-west; and the second, a mile and a-half further up the creek, where brown carbonaceous sandstones, dipping south-west, overlie grey shales. To the west of the town of Abington and the Bundaberg road is the Isis Scrub. The scrub is on a red volcanic soil. In sinking wells in the scrub the coal-measures have been reached, and in one case a thin seam of coal was pierced.

It will be noticed, in the descriptions just given of the rivers and creeks north of the Burrum River, that although numerous thin seams of coal varying from 1 to 18 inches in thickness crop out from time to time, yet no seams of workable thickness are exposed to view, as is the case in the latter stream. This, however, is by no means proof that such seams do not exist; for, as has been shown, the thickness of the rocks whose outcrops are exposed to view in these watercourses form but a very small proportion of the total thickness of the coal-bearing rocks existing, long distances being traversed without any section being seen. There is every probability that seams of coal, of sufficient thickness to pay to work, do exist in this northern part of the field; but they will only be discovered by the putting down of a series of shafts or boreholes.

APPENDIX A.

BOREHOLES.

No. I.

	Ft.	in.
Surface formation	21	0
Yellow sandstone	3	0
Grey sandstone	2	8
Yellow sandstone	4	10
Grey sandstone	26	0
	57	6

No. II.

	Ft.	in.
Surface formation	19	0
Yellow and grey sandstone	15	0
Brown and blue shale	12	0
Grey shale	1	4
Dark coaly shale	13	11
*Coal	1	6
*Dark coaly shale	11	11
*Coal	0	5
*Dark coaly shale	3	2
*Coal	2	0
Coaly shale	6	3
	86	6

No. III.

	Ft.	in.
Surface formation	18	9
Brown shale	10	3
Grey and blue shale	11	0
Ironstone	1	0
Grey shale	4	0
Grey sandstone	11	0
Ironstone	3	3

No. III.—*Continued.*

	Ft.	in.
White clay	0	6
Grey sandstone	6	9
Dark shale	3	0
Coal	0	3
Dark coaly shale	2	9
Ironstone	0	6
Fireclay	2	0
	72	0

No. IV.

	Ft.	in.
Surface formation	26	8
Grey shale	7	10
Dark coaly shale	0	6
Coal	11	7
Band	0	3
Coal	0	4
Coaly band	1	2
Coal	0	4
Dark shale	2	10
Grey shale	9	6
Dark coaly shale	1	3
Coal	0	9
Coaly shale	0	6
Coal	0	9
Dark coaly shale	6	3
Dark-grey shale	4	6
Coal	0	7
Grey sandy shales	12	11
	88	6

No. V.

* Bridge seam.

No. V.

	Ft.	in.
Grey sandy shale ...	19	0
Surface formation ...	27	6
Light mottled shale	3	3
Dark coaly shales ...	4	4
Coal ...	0	5
Coaly shale	0	8
Grey shale ...	3	2
*Green sandstone ...	1	1
*Dark coaly shale ...	1	9
*Grey shales	17	1
	59	3

No. VI.

	Ft.	in.
Surface formation ...	21	8
Brown shale	2	8
Light-grey shale ..	2	0
Coal ...	0	3
Grey coaly shale ...	4	2
Coal ...	0	3
Dark coaly shale ...	5	10
Coal ...	0	5
Dark coaly shale ...	4	3
Coal ...	0	2
Dark coaly shale ...	2	10
Grey sandy shale ...	5	3
	59	0

No. VII.

	Ft.	in.
*Surface formation	16	6
*Yellow and grey sandstone	8	6
*Hard grey sandstone	16	6
	41	6

No. VIII.

	Ft.	in.
*Surface formation	12	0
*Hard yellow and grey sandstone	33	10
Dark coaly shale ...	2	2
†Coal	1	10
†Coaly shale	0	5
†Coal	0	3
†Dark shale	7	8
†Coal	0	3
Grey coaly shale ...	2	1
Grey sandy shale ...	6	0
	66	6

No. IX.

	Ft.	in.
Surface formation ...	17	0
Brown shale	1	0
Coal ...	0	8
Brown coaly shale...	0	4
Coal ...	0	3
Brown coaly shale...	1	7
Coal ...	0	3
White clay ...	0	11
Grey shale ...	9	6
Sandy shale	9	0
Coal ...	0	3
Grey shale ...	3	3

No. IX—*continued.*

	Ft.	in.
Dark coaly shale ...	2	9
Coal ...	1	1
Dark coaly shale ...	4	8
Coal ...	0	4
Dark-grey sandy shale	19	2
	72	0

No. X.

	Ft.	in.
Surface formation ...	19	0
Black shale...	9	0
Coal ...	0	7
Grey coaly shale ...	9	11
Dark shale ...	5	0
‡Coal	2	7
‡Dark coaly shale ...	2	5
‡Coal	1	6
‡Dark shale	1	3
‡Coal	1	2
Dark coaly shale ...	5	1
Dark sandy shale ...	3	10
Dark coaly shale ...	1	8
Ironstone ...	0	4
Grey sandy shale ...	24	0
§Coal	1	4
§Sandy shale	0	3
§Coal	3	1
§Coaly shale	0	11
	93	0

No. XI.

	Ft.	in.
Surface formation ...	25	0
Yellow sandstone ...	5	4
Coal ...	1	1
Brown coaly shale ...	1	1
Grey coaly shale ...	3	0
Grey shale ...	2	0
Dark coaly shale ...	1	3
‖Coal	2	1
‖Grey coaly shale ...	2	7
‖Coal	2	1
Dark shale ...	1	0
Grey shale ...	1	6
	48	0

No. XII.

	Ft.	in.
Surface formation ...	19	0
Grey sandy shale ...	17	0
Yellow sandy shale	1	5
Grey sandy shale ...	8	11
Grey sandstone ...	3	8
Grey sandy shale ...	11	6
Dark-grey shale ...	3	11
Coal ...	1	1
Coaly shale ...	4	6
Grey sandy shale ...	14	0
Coal ...		9
Grey coaly shale ...	1	8
Grey shale ...	3	7
	110	0

Queensland Colliery Company's Shaft.

	Ft.	in.
Surface formation ...	34	10
Fireclay ...	7	0
Black coaly shale (containing *Pecopteris*)	5	9
Sandy clay ...	4	10
Black shale...	0	3
Coaly shale...	8	4
Coal ...	2	1
Black clay ...	0	11
Light fireclay	5	6
Coaly shale...	6	11
Coal ...	1	0
Fireclay ...	1	6
Dark coaly shale ...	5	0
Coal ...	0	9
Fireclay	1	3
Dark shale ...	3	0
Sandy fireclay ...	13	8
Striped sandstone ...	11	8
Ironstone ...	0	3
Coaly shale...	9	0
Fireclay ...	2	1
Coaly shale...	3	3
Coal ...	0	6
Coaly shale...	3	6
Coal ...	0	3
Black shale...	1	3
Fireclay ...	3	4
Shale ...	4	5
Coal ...	0	7
Dark shale ...	0	4

Coal

* Sandstone outcropping at bridge. † Bridge seam. ‡ Lapham seam. § Burrum seam. ‖ Watson's seam.

BOREHOLES—*continued*
QUEENSLAND COLLIERY COMPANY'S SHAFT—*continued.*

	Ft.	in.		Ft.	in.
Coal ...	0	4	Fireclay ...	6	11
Black shale..	0	6	Striped sandstone and ironstone...	4	5
Coal ...	0	3	Striped sandy shale and ironstone	7	2
Fireclay ...	2	8	Shale ...	3	4
Sandstone (with ironstone bands)	7	8	*Coal ...	0	6
Light clay ...	1	11	*Shale ...	1	1
Coal ...	0	9	*Coal ...	1	1
Black shale ...	0	6	*Shale ...	1	6
Hard sandy fireclay	4	7	*Coal ...	0	11
Shale and ironstone	4	2	Fireclay ...	3	6
Shale (containing fossil ferns) ...	1	8	Coaly shale...	1	0
Sandy clay ...	3	0	Shales ...	11	7
Coal ...	0	3	Coal ...	0	9
Fireclay and bands of ironstone...	6	10	Fireclay ...	1	3
Dark coaly shale and ironstone ...	5	1	Fireclay with nodules ...	2	6
Black shale...	2	9			
Coal ...	0	3		234	8

* Company's seam.

APPENDIX B.
ANALYSES OF COALS FROM THE BURRUM COAL FIELD.

Name of Seam.	Water.	Volatile Hydro-carbons.	Fixed Carbon.	Ash.	Sulphur.	Specific Gravity.	Coke.
I. Whitley's Shaft (Queensland Collieries Company's seam)	...	26·6	68·4	5·0	...	...	...
II. Beaufort Seam (Beaufort shaft) ...	...	31·5	64·0	4·5	...	...	...
III. Burrum Seam ...	...	29·8	62·2	8·0	...	...	...
IV. Queensland Collieries Company's seam ...	2·50	30·35	64·30	2·50 (grey)	0·35	1·24	66·80
V. Lapham or Torbanelea Seam (Torbanelea Colliery, bottom coal)	2·00	28·00	61·60	8·00 (grey)	0·40	1·31	69·60
VI. Ditto (top coal) ...	2·25	29·15	66·50	2·10 (grey)	...	1·26	68·60
VII. Burrum Seam (Torbanelea Colliery) ...	2·75	28·00	65·55	3·25 (reddish)	0.45	1·27	68·60

NOTE.—Analyses I., II., and III., are taken from Mr. A. C. Gregory's Report on the Burrum Coal Mines, 1879.
Analyses IV., V., VI., and VII., are by myself.

Mr. Henderson, C.E., manager of the Maryborough gas-works, kindly gave me the following returns from twenty months' actual work with the coal from the Lapham or Torbanelea seam:—

Gas ...	10,200 cubic feet per ton of coal, candle power 14·73	
Coke ...	1,460 lbs, ,, ,,	or 65 per cent.
Tar ...	10·5 gallons ,, ,,	
Ammoniacal liquor ...	16·0 ,, ,, ,,	

This seam has proved, in practice, to be superior to either the Queensland Collieries Company's seam or the Burrum seam for gas-making purposes.

The analyses of the coals from the Burrum would show that, with reference to the volatile hydrocarbons, of which, of course, a high percentage is necessary for gas-making purposes, they are not quite as good as the Newcastle coals (New South Wales). Fourteen samples of the latter averaged 37·55 per cent. of volatile hydrocarbons, including water; while the average of seven samples from the Burrum is 31·5, that is also taking the hydrocarbons and water together.

The ash, which represents so much of worse than useless matter, is by no means high: the highest result being 8 per cent. and the lowest 2·1 per cent.; the average being 4·6 per cent., as against an average of 4·97 per cent. in the Newcastle coal (New South Wales). It should be mentioned that the Burrum samples are from shallow depths, where the ash is generally higher. The ash is of a very light red or grey colour.

The sulphur, averaging 0·4 per cent. in the three samples in which I determined it, is very low indeed, and the coal will compare favourably in that respect with coal from any part of the world. Unfortunately, however, in all the analyses of the Burrum coals hitherto made, the sulphur has not been determined. The percentage of this constituent is most important in coals used for gas-making. Freedom from sulphur, too, is a great advantage in many metallurgical processes.

The average specific gravity of four samples was 1·27.

The cokes from the Queensland Collieries Company's seam, the Lapham or Torbanelea seam, and the Burrum seam, are all good, coherent, dense cokes; that from the first-named being the densest.

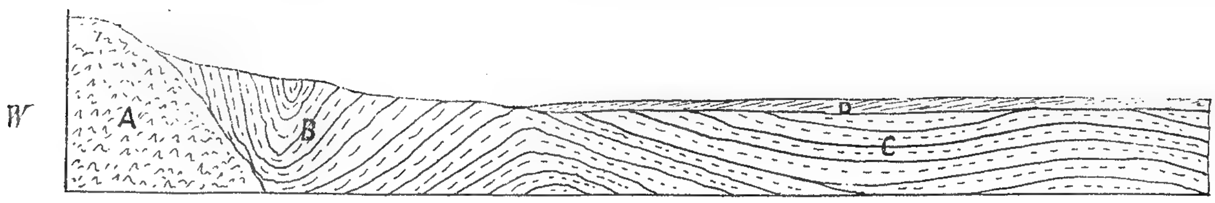
The Burrum coal is not so good a steam-coal on account of its tenderness, it being very easily broken up by attrition, as I have before stated. However, I am of opinion that there will be a great improvement in it, in this respect, at greater depths.

W. H. RANDS,
Assistant Government Geologist.

Price, 6*d.*]

By Authority: JAMES C. BEAL, Governmemt Printer, William street, Brisbane.

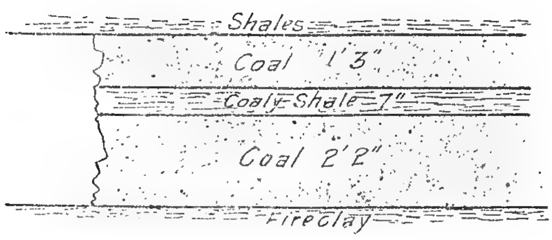
PLAN No. 1



Section across the Burrum Coalfield

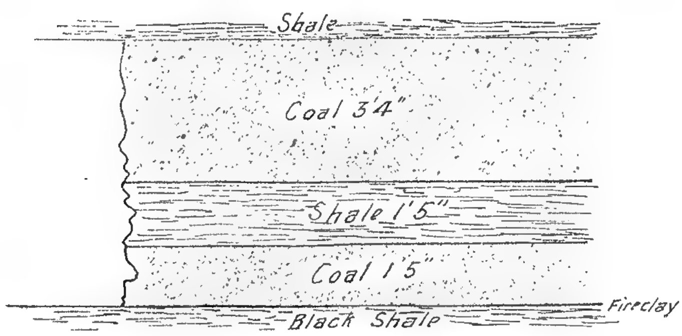
A Granite *B Metamorphic Micaceous Schists*
C Coal-measures *D Overlying Sandstone*

PLAN No. 3



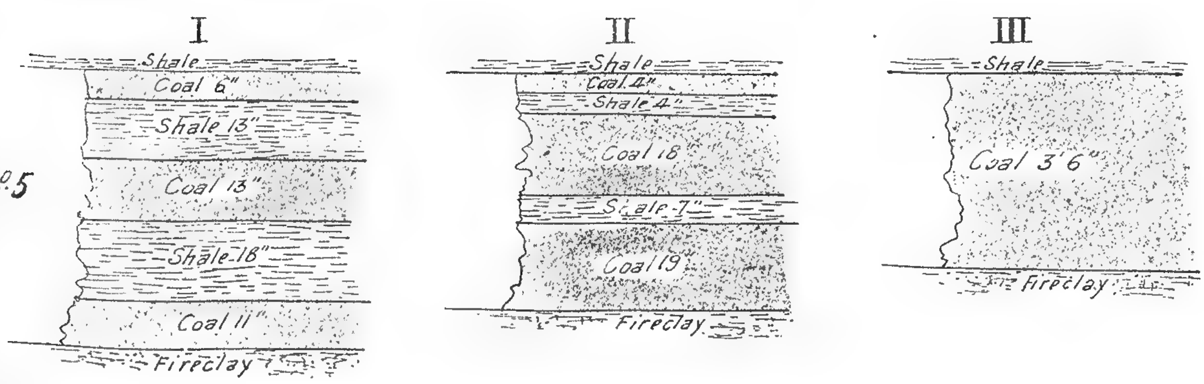
Section of the Burrum Coal Seam

PLAN No. 4



Section of the Lapham or Torbanelea Seam

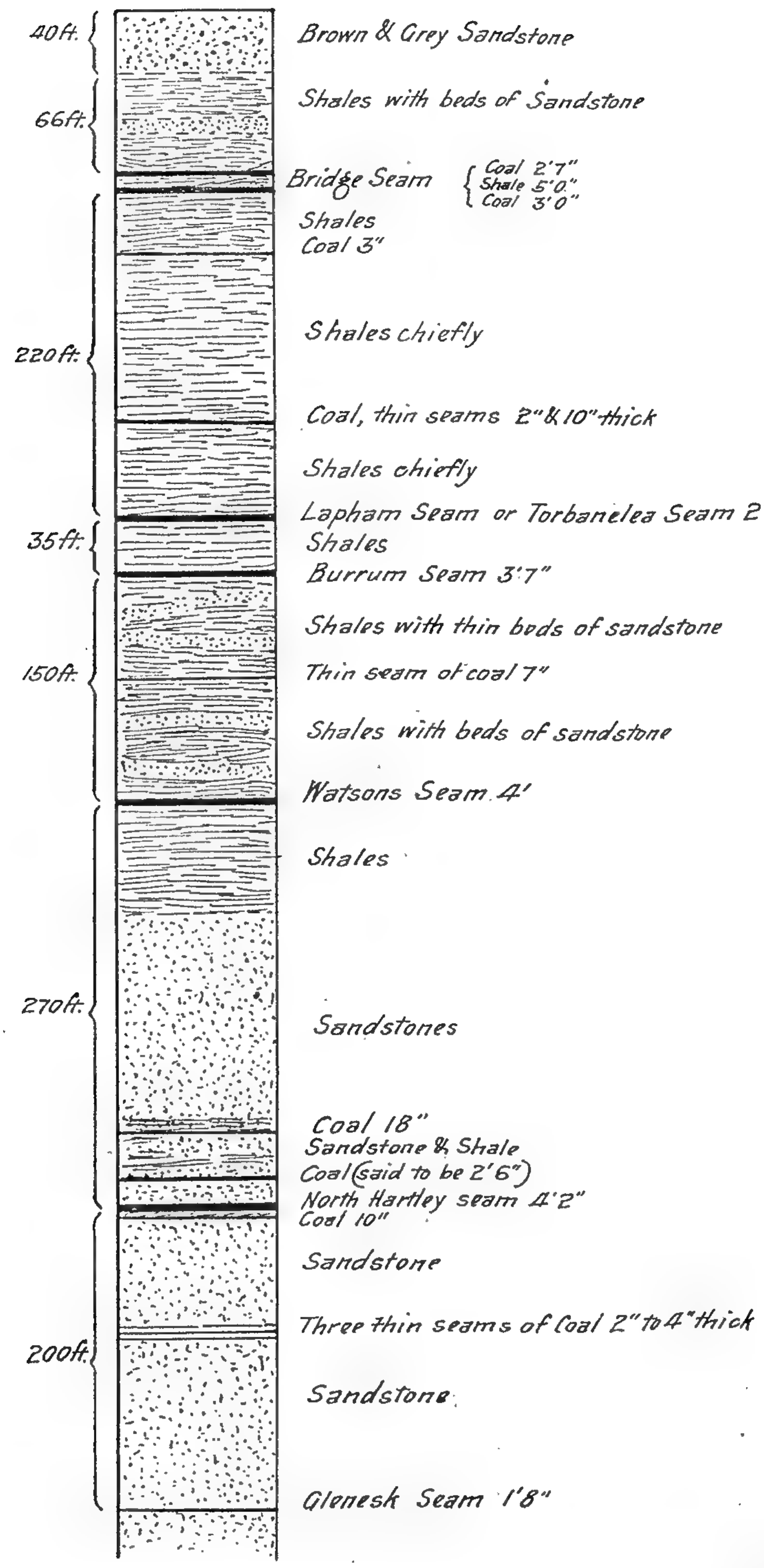
PLAN No. 5



Sections of seam worked at the Company's Mine

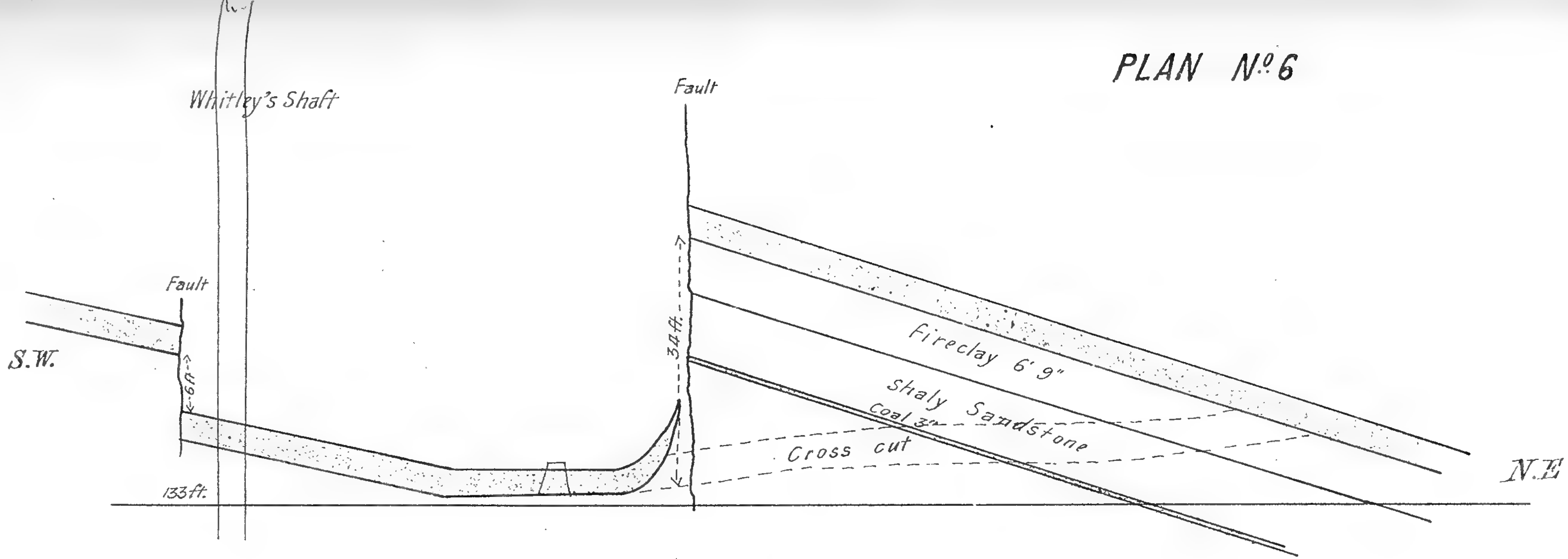
I Section at pit bottom. II Sec. in North westerly level 430 ft from pit bottom. III Sec. in North Westerly level 750 ft from pit bottom.

PLAN No. 2



Vertical Section of Strata. Shewing the Seams of Coal between the Railway Bridge and the Glenesk Seam at the crossing place of the Bunderberg Road.

PLAN No. 6



Section across Whitley's Mine in a N.E. direction shewing faults.

1886.

QUEENSLAND.

REPORT ON THE GOLD DEPOSITS IN THE NEIGHBOURHOOD OF NANANGO.

(BY THE ASSISTANT GOVERNMENT GEOLOGIST).

Presented to both Houses of Parliament by Command.

Approaching the township of Nanango by the main road from Barambah, a series of hard sandstones, quartzites, and slates is traversed. The township itself is situated just on the boundary line of this series, for immediately south of the township a grey granite occurs which extends across the range forming the watershed of the Brisbane and Burnett waters, to and beyond Taromeo Station.

The Nanango Diggings are situated in the scrub, about 1 mile a little north of east of the township: they are on the Burnett falls of the Brisbane range.

Passing along the road from Nanango to Mount Stanley, at the foot of the range a hard dark-coloured altered sandstone occurs. Three hundred yards further up the range a soft grey slate dips about 40 degrees to the west. Immediately beyond this, and overlying it, is a felspathic sandstone, coloured red and brown with oxide of iron. It shows, as a rule, no signs of stratification, although here and there, where it is of a very fine character, thin laminations were visible. In places, again, it passes into a fine white kaolin clay. It has evidently been formed from the decomposition of some highly felspathic rock; in all probability from a porphyry.

It is in this rock that the gold has been obtained. The gold occurs in small strings or veins of quartz running through the rock in various directions, and also to a small extent in the rock itself.

There are no true reefs or lodes whatever.

Numerous shafts have been sunk to a small depth on this formation, but it will only be necessary to give a description of one or two of these working places.

About a mile from the township, and just to the right-hand of the road leading to Mount Stanley Station, are old workings on small veins of quartz of from ¼ to 3 inches thick, with a slight dip to the east; they are lying one above the other, and are separated from one another by a few inches to a foot or more of rock, through which small and nearly perpendicular strings or branches of quartz run from one vein to the other. (Plan No. 1.)

The quartz is crystallised and white; sometimes coloured red with oxide of iron, or black with the magnetic oxide. The shaft has fallen in, so that only the upper part is visible; but I was informed by one of the men who sunk it that it was 132 feet in depth, and that at that depth it entered a flat formation standing on its edges. Near the surface these small veins contained good gold, but below the depth of 20 feet or so no colours of gold were obtained all the way down.

At a second working, about half-a-mile south of the above through the scrub, a shaft 25 feet deep has been sunk also on flat lying veins, dipping a little to the east, which occur every foot or so between two walls about 6 feet apart, along which are very thin threads of quartz. The veins are similar in character to those above described, except that some of them contain more magnetic oxide of iron.

It would appear from the bending down of the veins on the footwall as though the walls had been formed by a slip or fault. (Plan No. 2.)

Veins occur in the rock on the eastern side of the slip, but appear not to contain any gold.

The gold is chiefly very fine, but coarse gold is visible in some specimens of quartz. A miner who has been working here for some time believes that if the whole of the material between these walls (with the exception of irregular patches of an impure kaolin clay) were taken out and crushed it would give a result of about ½ oz. of gold per ton. Should this be the case, it would pay well, for the formation is an extremely easy one to work.

These veins are small segregation veins formed by quartz segregating in the cracks and joints of the rock.

The summit of the range here is covered with a layer of basalt. Basalt also occurs about 4 miles to the south-west, forming the cap of a small conical hill of granite in the Nanango paddock.

Some true quartz reefs occur in the district in the slate series, one of which, lying about 200 yards west of the Telegraph office in the township, can be traced for some distance in a south-south-west direction. A specimen of quartz containing gold was picked up on its outcrop. No prospecting has been done on it.

Two miles south of Nanango, in the granite there are two reefs of a glassy crystallised quartz running east and west, and parallel with them is a dyke of felspar porphyry. No trace of gold has yet been found in these reefs. The granite on these ridges is covered with a granite debris, cemented together with oxide of iron.

THE

THE SEVEN-MILE DIGGINGS.

The Seven-mile Diggings lie just to the south of the road to Brisbane, and are about 7 miles south-east of Nanango, on the Brisbane side of the range. The country here is a grey granite (white orthoclase and oligoclase felspars, quartz, mica, and a little hornblende); the granite is intersected in many places with dykes of felspar and quartz porphyries, and also of phorphyrite, which have a bearing varying between north-north-west and west-north-west.

Up to the present only alluvial gold has been found on these diggings. No gold-bearing reefs have yet been discovered.

At one time nearly 700 men were at work here. Colours of gold can be got from nearly any of the gullies or creeks in the neighbourhood, but the principal working places have been :—

Callaghan's Gully, which runs in a south-east direction into Yeraman Creek, about 1½ mile above its junction with Cooyar Creek; the lower part of Yeraman Creek itself; and Shepherd's Gully, which runs eastwards into Cooyar Creek about 1 mile below the junction of Yeraman Creek. Callaghan's Gully was the best of these, and from it about 700 ozs. of gold were obtained. In all the small ravines and gullies, and on the ridges on the eastern side of Callaghan's Gully, gold has been found; while in those on its western side no traces have been discovered pointing to the source of the gold as lying on the eastern side. A quartz reef, running parallel to and alongside a dyke of felspar porphyry, outcrops on one of these ridges, and on it a few prospecting holes a foot or two in depth have been put down, but without any favourable result.

Yeraman Creek, too, has given fair returns; a dish I washed from a point 1 mile above its junction gave a very fair prospect; the washdirt was of granite debris and was here only a foot or two in depth from the surface.

Shepherd's Gully was the next richest to Callaghan's. Gold was obtained nearly all the way up for about 1¾ mile. The gold in this gully was coarser. The largest nugget weighed ½ oz.

In many places gold can be got by surfacing; for instance, on the ridges east of Callaghan's Gully before referred to, and on the Brisbane road near the head of Shepherd's Gully.

In the granite there are numerous reefs of a crystalline quartz with a glassy lustre, often iron-stained and of a gossany nature. No gold at all has been found in this quartz, but most of the reefs have a casing consisting of a fine granite debris, which varies generally from 1 to 4 inches thick, and which often contains colours of gold. This casing often penetrates into cracks in the quartz itself. Many of these reefs, especially those in the vicinity of the gullies and creeks in which alluvial has been obtained, have been prospected by sinking shafts on them.

A shaft 15 feet deep has been sunk on a reef bearing north and south, with a slight underlie to the east, situated near the head of a gully running into Yeraman Creek; the quartz is 10 inches in width, with a casing averaging 2 to 3 inches; the walls are well defined; the quartz, especially at the bottom of the shaft, and the granite walls contain iron pyrites. Traces of gold were obtained in the casing.

On the opposite side of this gully, 60 yards off and parallel, is another reef similar in character.

A similar reef bearing east and west, and running parallel with a dyke of porphyrite, crosses the Shepherd's Gully near the heads. Trenches and holes on this, too, have failed to lead to the discovery of any gold.

Again crossing Callaghan's Gully near its junction is another reef, close to a dyke of very coarse-grained granite (pegmatite), containing large crystals of tourmaline. I collected specimens of quartz from at least a dozen of these reefs, crushed and washed them, and with one exception I did not get the slightest trace of gold, and that one contained but a mere trace of gold.

It would appear, therefore, that these quartz reefs could not have been the source of the little alluvial gold found in the gullies.

Mineral selections have been taken up about 8 miles east-south-east of the Seven-mile Diggings.

Several copper lodes outcrop here in the same granite formation. Their outcrop can be followed at the surface by lines of redish gossan. Their general direction is east and west. On one of these lodes which bears west 10 degrees north and underlies 20 degrees to the south, a shaft 90 feet deep has been put down on the underlie. The lode is between 2 and 3 feet thick, and to the depth reached the one consisted of the red oxide and blue and green carbonates of copper. Very rich pieces of this ore can be picked off the heap at the surface. The quartz which forms the matrix of the lode is crystallised and honeycombed and contains fine gold.

I should mention the fact that a few rounded and waterworn crystals of cassiterite (tin-stone) have been met with in some of the alluvial in this district; my informant being Mr. O'Sullivan, to whom I am indebted for kindly accompanying me to the various places mentioned in this report, and who has spent much time in prospecting the district. He showed me a crystal he found which was of the variety known as "amber tin."

THE SCRUB PADDOCK DIGGINGS.

While in the neighbourhood of Nanango I visited, according to my instructions, the Scrub Paddock, which is situated about 23 miles north-north-east of that town, also on the range dividing the Brisbane from the Burnett waters. The Scrub Paddock, as its name implies, is a natural paddock completely surrounded by scrub, the only entrances being where the Gooroomjam Creek enters it, and where a road has been cut through the scrub on the way to Yabba Station.

Nearly all the gold which has up to the present time been obtained is from two creeks, one of them on the Burnett falls, known as "German's Gully" or "Dry Gully;" the other on the Brisbane falls, and known as "White's" or "Manaramby Creek."

The former of these two has proved the richest. Near its head nuggets as high as 13 ozs. were obtained, and several from 7 to 9 ozs. Lower down again, the gold is much finer in size. This gully, which runs into Gooroomjam Creek (a tributary of Barambah Creek), has been worked for about a mile down from its head. In Gooroomjam Creek there are some old workings, but I believe that only a very small amount of gold was obtained from it.

Rounded pebbles of ironstone (hæmatite) were nearly always found in conjunction with the best patches of alluvial in German's Gully. These pebbles themselves contain gold. An assay of them gave 16 dwt. 8 gr. of gold per ton.

Manaramby

Manaramby or White's Creek has been worked for some 2 miles down from the paddock.

The gold from these creeks was very pure, its value at the Sydney Mint being £4 2s. 6d. per oz.

The reefs from which this alluvial gold must have come are situated on the summit of the Brisbane Range, in the paddock. This area consists almost entirely of fine-grained micaceous diorite.

This rock is flanked on the Brisbane side by a grey granite, of which the spurs on either side of Manaramby Creek consist. Below this again, or about 4 miles from the heads, is a series of schists, conglomerates, and shales (the latter are in places so carbonaceous as almost to resemble coal in appearance), which dip steeply at an angle of about 45 degrees in direction varying from west to west 30 degrees north.

THE WILD HORSE REEF

bears north 10 degrees east, and underlies to the east to a depth of 20 feet and then bends round to the west. The reef is very narrow and does not average more than 4 inches in width of quartz with a white clay casing, though at 40 feet, the depth of the deepest shaft, it is increasing in size. This reef has been worked almost entirely by one man alone, who has put down two or three shafts to a depth of about 38 feet when a solid mundic, consisting chiefly of iron pyrites with a little copper, comes in. Above this level the reef is of a white quartz with gold showing through it. He burns this quartz to render it more friable for crushing, and then crushes it with a stamper worked by hand; with this rough method of treatment he averages over 2 ozs. per ton, and a large percentage of the gold must be lost through insufficient crushing, some of the gold being in a very fine state of subdivision. This reef has been traced for a quarter of a mile along the surface.

One hundred yards north of the main shaft, on the Wild Horse Reef, is an outcrop of a reef of calcite with a little gossany-looking quartz. The prospects on it have shown no gold.

BLACK WATCH REEF

is situated about one-third of a mile south-west of the Wild Horse Reef on the top of the range. It bears east 25 degrees north, with a very slight underlie to the south.

The reef varies greatly in width near the surface; the quartz is only from 2 to 4 inches in width, while at the bottom of the shaft, which is 76 feet in depth, there is a width of nearly 3 feet between the walls with 10 inches of quartz on the hanging-wall and 2 inches on the foot-wall. The mullock between is full of strings of calcite and also quartz. These strings may gradually join at deeper levels, and fill the whole width between the walls with quartz.

The upper part of the shaft passed through stone very rich in carbonates of copper. Some rich specimens of this ore are to be seen in the paddock; the quartz was very ferruginous. At 35 feet the stone changes into mundic, consisting greatly of iron pyrites with some copper pyrites, and here and there some crystals of galena. The reef can be traced along the surface for over half-a-mile. Specimens I crushed and washed from this reef gave very good prospects. No crushings have been made of the stone taken from this reef; it is all packed in the paddock ready for crushing.

The following are assays of stone from this reef, made by Mr. M. D. Hamilton, of the Phœnix Assay Office, Gympie, kindly supplied me by Mr. Bushnell, of Yabba Station:—

1. A piece of the ore burnt in a forge, which resembled granulated copper, gave—

Copper	70 per cent.
Antimony	8 „
Iron	5 „
Silica and sulphur	7 „

One ton of sample contains 16 dwt. 8 gr. of gold, and 80 oz. 17 dwt. of silver.

2. Sample weighed 33 lb., and consisted of quartz, blue carbonate, and yellow sulphide of copper marcasite, and ordinary iron pyrites. This gave—

4 oz. 15 dwt. of gold, and 11 oz. 0 dwt. 8 gr. of silver per ton.

By crushing and treating in a berdan pan with mercury, it gave—

	Oz.	dwt.	gr.	
Gold, equal to	1	17	8	per ton of sample.
Silver „	1	19	8	

The balance was obtained by an assay of the tailings.

3. Sample weighed 64 lbs., consisted of quartz (much stained with carbonates of copper), sulphide of copper, marcasite, and ordinary iron pyrites. This gave by crushing and amalgamation—

	Oz.	dwt.	gr.	
Gold, equal to	1	9	4	per ton of sample.
Silver „	1	16	4	

By fire assay—

	Oz.	dwt.	gr.	
Gold, equal to	4	3	1	per ton of sample.
Silver „	9	17	21	

4. Sample consisted of quartz, oxide of iron, with traces of copper. This gave by simple crushings and amalgamation gold equal to 48 ozs. per ton of sample.

By fire assay—

	Oz.	dwt.	gr.	
Gold, equal to	51	15	3	per ton of sample.
Silver „	10	10	16	

The size of this sample is not given.

The 1st, 2nd, and 3rd samples are evidently from the lower levels, and much of the gold would be lost by treatment in the ordinary manner. A smelting process would be necessary to extract most of the gold.

Just 50 yards or so south of this reef are two reefs of calcite with iron-stained quartz similar in character to that referred to above as close to the Wild Horse Reef.

About half-a-mile east 30 degrees north of the Black Watch Reef is a reef running north and south with an underlie to the west. A shaft was sunk on it to a depth of 40 feet, and at that depth it was 2 feet in width, consisting of 1 foot of ironstone (hæmatite), 10 inches of pyrites, and 2 inches of quartz.

12″	10″	2″
Ironstone.	Iron pyrites.	Quartz.

The reef was much narrower at the surface than lower down.

An assay of the mundic gave 2½ ozs. of gold per ton. Two assays of the ironstone gave 15 dwt., and 9 dwt. 19 gr. of gold per ton, respectively.

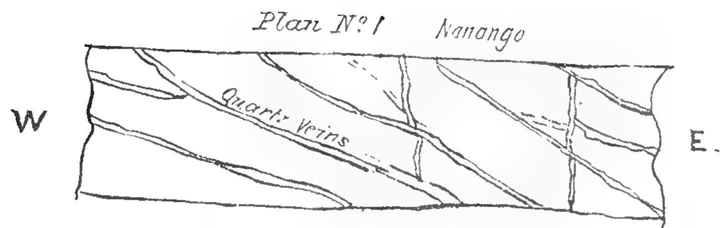
There are outcrops of several of these ironstone lodes visible, and it is from these that the water-worn pebbles of ironstone in the alluvial were probably obtained.

In various parts of the paddock, especially near the head of Gooroomjam Creek, reefs of calcite with a brownish quartz occur. In one of these gold was obtained in the quartz to a depth of 10 feet, and then this quartz became copper-stained and no more gold was found.

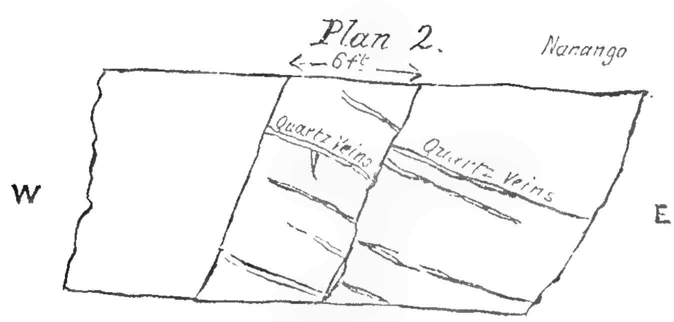
W. H. RANDS,
Assitant Government Geologist.

Price, 3d.]

By Authority: James C. Beal, Government Printer, William street, Brisbane.



Section shewing some of the Quartz Veins



1887.

QUEENSLAND.

REPORT ON A COBALT LODE AT THE BLACK SNAKE, NEAR KILKIVAN.

(BY WILLIAM H. RANDS, ASSISTANT GOVERNMENT GEOLOGIST.)

Presented to both Houses of Parliament by Command.

Gympie, 31st December, 1886.

In accordance with instructions received from Mr. Robert L. Jack, Government Geologist, I visited the cobalt lode discovered by Mr. F. Smith in the neighbourhood of the Black Snake, near Kilkivan.

The lode is situated on the eastern slope of a steep and narrow spur, running in a northerly direction from Mount Coora, and which separates the head of Fat Hen Creek from a steep gully which joins it at the northern end of the spur.

The lode can be traced running in a nearly due north and south direction from a point about 20 chains north of the summit of Mount Coora to the boundary of the serpentine with the schists, which is about 22 chains south of that hill—making a distance of over half-a-mile.

A tunnel has been driven about 80 feet on the back of the lode at a spot 14 chains north of the summit of Mount Coora. Here the lode is outcropping about 30 yards down the slope of the spur, which inclines at a very steep angle down to Fat Hen Creek.

The lode dips into the spur, underlying about 50 degrees to the west.

The country rock of this spur is a light-coloured serpentine.

At the surface the chief ore-bearing portion of the lode measures 21 feet in width; in addition to this there is on the foot-wall a talcose casing several feet thick through which the cobalt ore runs in irregular veins and patches, some parts of it being very rich in ore, and on the hanging-wall a material consisting of silicates of magnesia and alumina, with a small percentage of silicate of nickel—a substance resembling "pimelite," though not quite so rich in nickel as that mineral usually is.

The ore occurring in the main portion of the lode is that known as "earthy cobalt ore," which is a hydrated oxide of manganese, with oxides of cobalt, nickel, and copper, in varying proportions. It is a variety of the mineral "wad" or bog manganese. In colour it is nearly black, but with a bluish tinge.

The lode-stuff, or gangue, consists chiefly of a hard brown siliceous material, which in parts is so friable that the ore can be got with the pick alone. In other places, again, the gangue is of a steatitic character. Bunches or pockets of pure steatite occur in the lode.

The earthy cobalt ore occurs throughout this gangue, sometimes in solid veins, sometimes in large botryoidal masses, but generally running in an irregular manner through it.

The following are some assays of this ore:—

—	Assay by—	Cobalt.	Nickel.	Manganese.	Copper.	Iron.
		per cent.	per cent.	per cent.	per cent.	per cent.
1. Surface ore	W. Vivian and Sons ...	2·75	2·25	65·00	...	...
2. Undressed ore	Staiger	7·50	2·12	...	...	...
3. Undressed ore	"	4·30	1·00	...	...	...
4. Dressed ore	"	22·20	3·51	2·36	0·10	29·13
5. Fair sample of lode	"	7·50	2·25	18·00	...	...

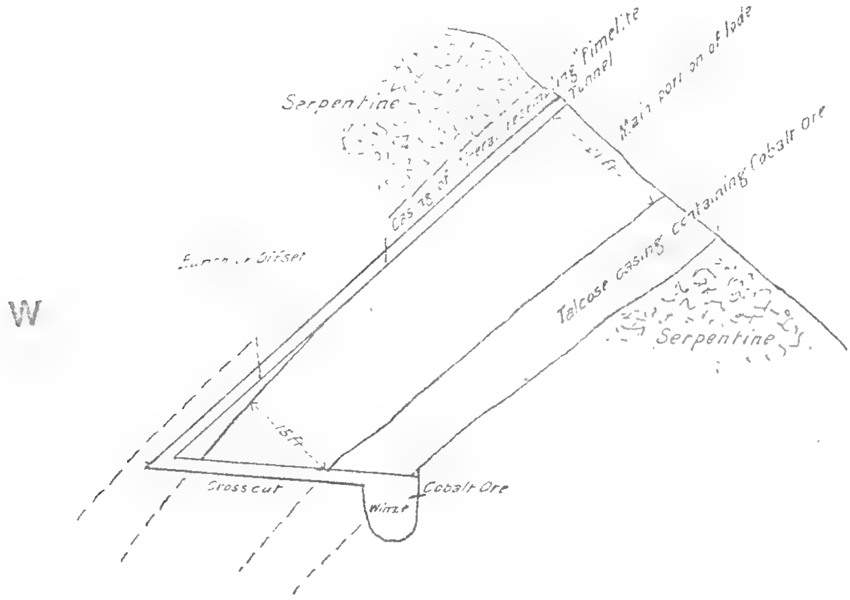
Assays Nos. 3, 4, and 5 were of specimens collected for the Queensland Commissioners of the Indian and Colonial Exhibition.

The assays of the undressed ore give an average of a little over 6 per cent. of cobalt. The ore is light in weight, its specific gravity being about 2·2; it would be therefore impossible to dress it by machinery to anything like the percentage of cobalt obtained in assay No. 4. Much, however, may be done by careful handpicking. The nickel averages about 2 per cent. The presence of nickel, however, in small quantities tends to lessen the value of the ore.

The tunnel is driven on the back of the lode at about 38 feet from the mouth of the tunnel. It passes through a "bunch" or "offshoot" from the lode, rich in cobalt, and several feet in width, with a break of serpentine in its centre. This "offshoot" is dipping steeply to the west, but cannot be traced at the surface.

The

The tunnel ends at 80 feet in the greenish mineral allied to "pimelite," and a cross-cut has been driven back through the lode, with a slight inclination to the east. The cross-cut passes through 14 feet of lode containing the cobalt ore, the top part of which is very friable, and then through from 8 to 10 feet of the talcose casing with cobalt ore through it, similar to that met with on the foot-wall at the surface. Beyond this again, or over 30 feet from the commencement of the cross-cut, another mass of the regular cobalt ore occurs. This has not yet been driven through to test its width. The portion first passed through in the cross-cut is probably the main body of the lode, however, as it has similar casings on either wall to those seen at the surface, and its position is in accordance with the regular underlie of the lode.



— Section showing position of lode & tunnel. —

From what has already been done towards the opening up of the lode, there can be but little doubt that it will prove to be a very valuable deposit, for the lode is of great width; it extends for over half-a-mile in length, and down to the present depth of the underlie shaft or tunnel is of a uniform character and richness. With reference to the quality and value of the ore, assays have shown that the undressed ores average about 6 per cent. of cobalt. This, according to the latest Sydney quotations, is worth about £13 10s. per ton, or £2 3s. per unit. It would probably not be a difficult matter to hand-dress it up to 10 per cent of cobalt, the value of which would be £23 12s. 6d. per ton, or £2 7s. 6d. per unit.

The expense of carriage of the ore from the mine will be much reduced by the opening of the Kilkivan Branch Railway, which runs within ten miles of the lode.

With reference to the uses of cobalt as a metal, it is not employed in the arts; certain of its compounds, however, are largely used as blue pigments by pottery-makers, glass-makers, and enamellers. The compounds chiefly thus used are the oxide of cobalt, and a silicate of cobalt and potassium known as "smalts."

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1887.

QUEENSLAND.

REPORT ON THE GEOLOGICAL FEATURES OF THE MACKAY DISTRICT.

(BY ROBERT L. JACK, GOVERNMENT GEOLOGIST.)

Presented to both Houses of Parliament by Command.

TO THE HONOURABLE THE MINISTER FOR WORKS AND MINES.

Having a rich soil and sufficient rainfall, Mackay has till recently depended mainly on agricultural and pastoral pursuits, but within the last few years some attention has been devoted to prospecting for mineral wealth.

In the immediate neighbourhood of Mackay there is abundant evidence of the presence of the coal-measures. In a railway cutting at Pleystowe Station ($11\frac{1}{4}$ miles from Mackay) shales and sandstones are seen dipping mainly southward at an angle of 10 degrees, with an intrusive mass of yellow felspathic porphyry, which has been quarried (on the south side of the railway) for ballast. At Greenmount Station ($12\frac{1}{2}$ miles) another cutting discloses a long section of dark clay shales, dark argillaceous sandstone and greenish-grey sandstone, dipping west at a low angle. The stratified rocks are here interrupted by two sheets of intrusive basaltic rock, which as usual assumes the form of "white trap" at its junction with the carbonaceous strata. At Pleystowe Bridge grey shales and sandstones occupy the bed of the Pioneer River, and dip at a low angle to west-north-west. A few chains below the bridge a sheet of basalt crosses the river, having been intruded along the planes of bedding. On the Walkerston and Eton road the flats and hollows mostly exhibit outcrops of rather highly-inclined gray sandstones and dark shales (dipping on the whole to the north-west), while the hills are composed either of basaltic or dioritic rocks or of yellow felspathic porphyry. These igneous rocks may be presumed to be intrusive through the stratified rocks like those seen in the railway cuttings above referred to. Plant-remains are not uncommon in the shales, especially in those portions of the latter which have been indurated by contact with the igneous rocks. They are, however, in very imperfect preservation. Only in one place (in the Eton Town Reserve) did I see one specimen (*Phyllotheca*) to which I should venture to give even a generic name. About half-way between Walkerston and Eton I saw a piece of silicified wood in the shales. Along this road the intrusive rocks occupy probably a larger area than the stratified rocks which they have displaced.

South of Eton, on the boundary line between portions 746 and 1017, the western side of a low hill shows, near its base, a series of very hard siliceous grits, containing occasional lines of small nodules of blue limestone, and some fine-grained dark ferruginous beds with remains of large reed-like plants. These beds dip north-west at 30 degrees; thence to the summit of the hill (about 500 feet above the sea-level) are beds of fine volcanic dust or ash, composed apparently of the débris of a silicated felspathic rock. Crystals of felspar are often developed in the ash, so that it is only on weathered surfaces that the rock can be distinguished from a porphyry.

A considerable thickness of dark, sometimes nearly black, shales and fine-grained sandstones is seen in a gully in portion 990, about a mile south of portion 1017. These shales and sandstones dip to the west and north-west at 20 degrees. It is said that actual coal, or at least something which was black, and which would burn, was discovered in or near portion 990.

In ascending the Coast Range, to the south of portion 990, the section is seen as in plan 4.

On the right bank of the Black Waterholes Creek some beds of fine-grained sandstones and black shales are exposed. Among the latter is one bed of highly carbonaceous shale, 3 inches thick. These strata are vertical, with a north and south strike. About two miles up the creek gray sandstones and dark shales dip to the west at 15 degrees. Near the same place some hardened, ashy sandstones are met with, traversed by a quartz reef.

In the vicinity of the road from Mackay to Bowen, from Constant Creek to St. Helen's Creek, a considerable thickness (perhaps 200 feet) of white sandstone, which would make an admirable building material, is seen at intervals on the low hills. This sandstone may be conjectured, from the preponderance of siliceous sandy material, to be the equivalent of the lower series of the Bowen River Coal Field. It is interrupted at intervals by masses of diorite and white or yellow porphyry. Between Macartney and Murray,

Murray, or Scrubby Creeks, it is seen to rest on a coarse, ashy conglomerate. In portion 909, behind the Beaumont Store, bluish shales are seen resting on a few feet of dark, coaly shale, with films of coal, the whole dipping slightly to the north. In a road cutting below the store, two beds of sandy fireclay are divided by 6 feet of diorite. The surface of the diorite is vericular, and the mass is, therefore, probably a bed, and not intrusive. A little to the east a diorite dyke is seen on the road. A water-worn sample of coal sent me by Mr. D. Lacy, and said to have come from the neighbourhood of St. Helen's, had a specific gravity of 1·46, and was composed as follows :—

Water	0·83
Volatile hydrocarbon	14·96
Fixed carbon (hard stony coke)	66·16
Ash (grey)	18·05
	100·00

The bottom of the Moonlight Gully alluvial diggings near Mount Britton is composed partly of diorite and partly of dark slate or shale, which dips to the south at a high angle. The shale has few or no marks of metamorphism, and is probably of coal-measures age.

Three miles south-west of Mount Britton Township, on a ridge near Mr. Richards's selection, some beds of ferruginous, and in part calcareous, sandstones are seen dipping to the north-west. They are full of fossils of the type of the middle or marine series of the Bowen River Coal Field. A large collection was made for the Museum.

On the right bank of Bee Creek, above its junction with Hail Creek, two shafts known as "Walker's" were sunk about nine years ago. The shafts have tumbled in, and there is no evidence to show whether they reached or cut through the strata exposed in the bank of the Creek, which are as follows :—

	ft.	in.
Dark shale with coaly streaks	5	0
Fireclay	0	5
Shale	0	8
Sandy fireclay	4	2
Coaly seam	0	4
Sandstone...	0	5
Laminated fireclay	0	3
Coaly shale	0	7
Fireclay	0	9
Coaly seam	0	3
Fireclay	0	3
Coaly seam	0	11
Fireclay	0	6
Coaly seam	0	2
Fireclay	0	2
Coaly seam	0	4
Fire sandstone	0	5
Coaly seam	0	6

The coaly seams of the above section are composed of black carbonaceous mud, with streaks and films of coal. A water-worn sample of coal from the bed of the creek had a specific gravity of 1·57, and contained—

Water	2·87
Volatile hydrocarbons	12·61
Fixed carbon (hard stony coke)	60 91
Ash (white)	23 61
	100·00

The strata are horizontal, but about a quarter of a mile down the creek some beds of greenish-grey sandstone, containing silicified wood, and bearing a strong resemblance to the Upper or Fresh-water Series on the Bowen River Coal Field, as exposed in Jack's Creek, dip slightly to the west.

In the bed of Walker's Creek, about two miles above its junction with Reedy or Carborough Creek, three small shafts have been sunk on a coal seam, but in no case has the bottom of the seam been reached. The following section is seen on the bank and in the shafts :—

	ft.	in.
Sandy shale with lines of very large ferrugino, calcareous nodules in upper part and lines of ironstone nodules in lower part (*Glossopteris* abundant; also a specimen of *Pecopteris*)	13	2
Laminated fireclay (sometimes sandy)	2	0
Compact fireclay (*Phyllotheca* abundant)	0	8
Dark shale	0	2
Coal	3	5
Grey shale	0 to 0	1½
Coal	0	2
Hard red ironstone	0 to 0	3
Coal (bottom not seen)	0	9

These beds dip at about 5 degrees to the east-south-east. Some sandstone beds in the neighbourhood contain silicified logs, and similar logs, evidently weathered out of the sandstone, bestrew the surface in the neighbourhood so thickly that one might imagine a forest to have been felled on the spot and subsequently petrified. In travelling from the mine to South Fort Cooper I found the country similarly strewn with silicified wood as far as Bee Creek. There can be no doubt that

that the coal-measures of this district are on the horizon of the Upper or Freshwater Series of the Bowen River Coal Field (Newcastle, Wollongong, and Bowenfels beds of New South Wales). A gratifying and promising circumstance is the absence of intrusive igneous rocks from this district. A specimen analysed had a specific gravity of 1·38, and contained—

Water	2·99
Volatile hydrocarbons	8·71
Fixed carbon (firm hard coke)...	84·74
Ash (pale brown)	3·56
	100·00

Coal is known to occur in Cherwell Creek, and near Lake Elphinstone Station, but I did not visit these localities.

The coal of Walker's Creek is an anthracite containing a higher percentage of fixed carbon and a lower percentage of earthly impurities than any coal of its class known in Queensland or New South Wales. It approaches in composition some of the best anthracites of Wales and Pennsylvania.

The Bee Creek coal visibly contains a large proportion of argillaceous impurity (resulting in 23·61 per cent. of ash). Purer seams, however, may exist in this locality than those which are exposed by the creek.

The St. Helen's coal contains too much argillaceous and siliceous matter (yielding 18·05 per cent. of ash) to be of workable quality. It must, however, be remembered that the sample analysed occurred as a boulder in the creek. The tendency of the forces which carry on the process of erosion would naturally be to disintegrate the more carbonaceous and consequently more tender portions of coal seams, and to leave as boulders only the harder and more stony portions.

Coal seams of workable thickness and of good quality are known to exist in the Mackay district, and others may with confidence be expected to be discovered in localities not yet explored. To the intrusion of igneous rocks among the coal-measures, and consequent metamorphism of the latter, the district is, however, indebted for the production of gold and other metals and minerals of economic value.

It is now known that the Gympie Gold Field, once classed as Devonian, is nothing more than a part of the Queensland coal-measures (equivalent to a portion of the carboniferous and a portion of the Peruvian formations of European geologists) which has been pierced by intrusive rocks, and to some extent mineralised. From what I have seen of that goldfield, I incline to the belief that the presence of carbonaceous rocks charged with pyrites is one of the essential conditions of the production of the gold. Daintree held that another and very important condition was the intrusion of masses of diorite.

In several places in the immediate neighbourhood of Mackay the doleritic or dioritic intrusive masses which interrupt the coal-measures, and sometimes the coal-measures themselves, are intersected by quartz reefs. In one of these, in selection 661, the country rock is a "quartz diorite." A reef occurs on the summit of a little hill, and underlies at 70 degrees to the south-east. A shaft cuts the reef at a depth of 6 feet, and follows it for 15 feet on the underlie. There are on an average about 6 inches of reef, of which a-third or a-half is quartz. The latter occasionally bulges to 9 inches or thins to three-quarters of an inch. The quartz is accompanied by a clayey gangue. It occurs generally in large transparent or translucent crystals, the interstices between the crystals being filled with decomposing brown hæmatite. I was informed that two samples assayed by Mr. K. T. Staiger, of Brisbane, gave respectively 1 oz. 5 dwts. and 3 ozs. 12 dwts. of gold to the ton. A number of specimens from this mine, which I saw in Mackay, contained visible gold. In Mr. Bell's selection (No. 615), south of Mount Chelona, two reefs occur in decomposed ferruginous felspathic sandstone on the southern edge of a low hill. The hill is composed of similar sandstone, dipping at 45 degrees to south-west, and intersected by a north and south diorite dyke. The first reef runs S.S.E. and underlies at 70 degrees to W.S.W. A shallow shaft has been sunk on it and shows 18 inches of well-defined reef, with 4 to 8 inches of brecciated gangue stuff on the hanging-wall, then 10 to 14 inches of quartz in large lumps. The quartz is seamed and veined with iron oxide. Some of it which I washed gave a fair prospect of fine gold. Two samples assayed are said to have yielded 9 dwts. gold and 17 dwts. silver and 16 dwts. gold per ton respectively. The second reef is seen on the surface a few feet to the north, and underlies at 70 degrees to the S.W. It has 14 inches of quartz on the hanging-wall with a lower vein 4 inches thick just at the surface of the water, which was standing in the shaft. The quartz vein has a brecciated gangue below it.

Mount Britton Township lies on the west side of "The Marlingspikes," in longitude 148 degrees 33 minutes E., and latitude 21 degrees 28 minutes S. (see Runs, Map of Leichhardt District, on the scale of 12 miles to an inch), and is reached by an easy, though rather roundabout, road from Mackay, from which it is distant about 75 miles. Plan No. 1 attached to this report shows principal reefs on the goldfield. It is based on surveys by Mr. J. Vivian Williams, formerly warden at Mount Britton. The ground has been taken up recently in other forms than those laid down on the plan; but no surveys of the present holdings have yet been made.

The workings on the Mount Britton Gold Field have hitherto been confined to two groups of reefs; the first, at the head of Nuggety Gully, comprises the Little Wanderer and other reefs, and the second, about three-quarters of a mile south, comprises the Edith May, Black Slates, and a few others.

The cap of the Little Wanderer runs up the slope of a steep hill on the south side Nuggety Gully, one of the branches of Oaky Creek. Its course is north 30 degrees west, and its underlie to west 30 degrees south at 42 degrees. The country rock is diorite. The upper, or No. 1 tunnel, has been driven on the course of the reef for 420 feet into the hill. The reef has been stoped out up to the surface from the level of the tunnel at 312 feet from its mouth. Beyond the inner end of the stope the reef shows only 1 or 2 inches of stone, consisting, to some extent, of calcspar, in which I saw some gold. The face of the stope from the tunnel up to the surface has 3 to 9 inches of stone, with a few short blanks. No. 2 tunnel is 96 feet below the level of No. 1 (130 feet on the underlie) and is 452 feet long. From a point 417 feet in (where the reef got thin and poor) the reef has been stoped out up to No. 1 tunnel. At the end of the tunnel the reef is "rock-bound" (*i.e.* not accompanied by gangue-stuff) and

and only half-an-inch in thickness. Up the face of the stope the reef gets thicker when approaching the No. 1 tunnel. For 75 feet from the mouth of the tunnel the manager informed me that the stone had averaged 8 inches in thickness and had crushed for 6 to 7 oz. per ton. An underhand stope from 6 to 20 feet deep extends from the mouth of the tunnel for 357 feet. Seventy-five feet from the mouth of the tunnel a winze is being sunk and has attained the depth of 86 feet. In the upper half of the winze the quartz occurs in small lenticular patches from half an inch to an inch in thickness. The lower half contains large patches of stone sometimes attaining a thickness of a foot, which is mainly on the hanging-wall. Near the bottom gold could be seen in the stone. There the reef has a wide gangue of veined chloritic and steatitic diorite. No crushings had yet been taken from the winze, although a parcel of about 15 tons was lying at grass and another of 20 tons had been carted to the mill. I was shown a box-full of specimens from the winze. They contained free gold imbedded in the quartz and calcspar. A whim shaft, 90 feet in vertical depth, has been sunk below the level of No. 2 tunnel, and is connected by a crosscut of 88 feet with the Little Wanderer. Where the reef was cut it was nearly vertical and 12 inches thick, but poor in gold. The reef was driven on to south 30 degrees east from the crosscut. For the first 30 feet it carried 3 to 9 inches of quartz. It was then intersected by a slip and carried good gold, but was shortly afterwards cut off by an east-and-west fault (which must shift it to the east). From this point to the end ($54\frac{1}{2}$ feet from the crosscut) the drive is in the country rock. It is intended to connect this drive with the winze sunk from the bottom of No. 2 tunnel. A tunnel (No. 3) has been driven on the reef 155 feet from the gully to north 30 degrees west, but the manager informed me that the prospects of this portion of the reef were not considered encouraging. The country rock is diorite to near the end of the tunnel, where it is replaced by black shale or slate. It is obvious that the system of mining pursued till lately in the Little Wanderer has been very unfavourable to the development of the mine, no "backs" having been left and the richer parts of the reef only having been taken out, so that all the faces now left are comparatively poor and uninviting.

A reef, possibly the Little Wanderer (the steeper inclination of the reef on the north side of the gully would account for its outcrop being deflected a little to the west), is cut about 4 chains north of the gully, in the old No. 2 North Claim, in a tunnel which has been driven 80 feet to the west. From the mouth of the tunnel to the reef the country rock is diorite. At the reef it changes to dark shale (slate). The stone is laminated quartz, 9 inches thick. There is a good deal of fine pyrites in the accompanying gangue. No crushings have ever been taken from this part of the reef.

Keeley and Valentine's Claim adjoins the old No. 2 Little Wanderer on the north. A whip shaft has been sunk 168 feet on the underlie (55 degrees) of a reef, which is possibly the Little Wanderer. As seen at the mouth of the shaft, the reef lies between a hanging-wall of diorite and a foot-wall of shale, and is 5 feet in total width, with a vein of calcspar 8 inches thick on the hanging-wall, and another of 5 inches on the foot-wall. From the bottom of the shaft a level has been driven 16 feet to the north-west and 15 feet to the south-east. At the north-west face of the level there is a thickness of 1 foot of stone—calcite and quartz intimately mixed, the quartz pseudomorphous after calcite. There is a wide soft gangue of débris of shale and diorite, much mixed with chlorite, steatite and iron oxide. At the south-east face of the level are about 6 inches of good-looking laminated quartz with some calcite in a gangue, composed mainly of shale débris. The quartz contains a good deal of fine pyrites. Up the shaft the stone is only visible at intervals, and is sometimes thicker than in the faces of the levels. I was informed by Mr. Keeley that one crushing of 10 tons (at the Little Wanderer machine) gave 1 oz. 7 dwts. 6 grs. of gold, and that the following assays were made:—

4th April, 1884, J. M. Smith Sydney—3 ozs. 5 dwts. 8 grs. gold.

20th May, 1884, Chas. Watt, Sydney—1 oz. 13 dwts. gold, and 1oz. silver.

11th February, 1885, Sydney Mint—1 oz. $11\frac{1}{2}$ dwts. gold.

The sample assayed at the Sydney mint was collected from the shaft impartially at intervals of 10 feet, and the total quantity averaged for the assay weighed $1\frac{1}{2}$ cwt.

A tunnel has been driven 240 feet into the hill south-westward from the mouth of the shaft, and shows several alternations of black and grey shale with diorite. The diorite seems to be interbedded with the shales, which dip at a high angle to the south-west. It contains lines of vesicles parallel with the bedding-planes of the shales. Several thin veins of quartz have been cut in the tunnel.

An east-and-west reef ("The Union") is cut in the No. 2. Little Wanderer Tunnel 15 feet from its mouth. It has 8 inches of stone—white quartz with a good deal of calcite. A shaft has been sunk on this reef east of the tunnel. It cuts the reef at 20 feet and follows the underlie (south) for 80 feet. There were 60 feet of water in the shaft at the date of my visit. Some stone was being raised from the 20-feet level and gave a very good prospect indeed. The manager informed me that 25 tons from the shaft crushed for 3 ozs. to the ton, and that gold showed freely on the east side of the shaft all the way down. The stone averaged 6 inches in thickness. A level was driven 100 feet to the west from the bottom of the shaft, and the reef was stoped out from this level to the surface.

The Evelyn Reef is cut by a crosscut, which runs south-west from the No. 1 Tunnel on the Little Wanderer, 144 feet from the mouth of the latter. It was cut at 40 feet from the hanging-wall of the Little Wanderer, with which it has a parallel course. It was driven on for 40 feet to south 30 degrees east. The reef is about 4 feet in total width (including gangue), and has a 3-inch vein of quartz on the hanging-wall and an 8-inch vein on the foot-wall. A trial crushing of 12 tons gave 15 dwts. of gold per ton. Although this result was no doubt disappointing, it seems to me that the Evelyn is a promising reef.

The Erratic Star Reef lies west of the Little Wanderer Reef on a high hill, and is cut at 132 feet in a tunnel (No. 4) which is driven into the hill southward to a distance of 306 feet. Its course is west 30 degrees south, and its underlie (very steep) to north 30 degrees west. The tunnel, as far as the reef, is in dark shale country. Two hundred tons were crushed from a shaft sunk on the reef higher up the hill, and yielded 1 oz. 3 dwts. per ton. No stone was crushed from the level of the tunnel. It is supposed that the level was not carried far enough to strike the shoot of gold worked in the shaft. The reef is very wide, and has a gnarled black clayey gangue with parallel veins of quartz and calcite all through. There may be about 12 inches of stone on an average, of which a large proportion is calcite. At the face the stone is mainly quartz.

Twelve

Twelve feet beyond the Erratic Star a parallel reef was cut in diorite country. It has 6 inches of quartz; said to prospect well.

About a mile south of the Little Wanderer is a second group of reefs connected by a good road with the Little Wanderer machine distant about three-quarters of a mile.

The Black Slates Reef has a shaft sunk over 80 feet on the underlie, which, however, was full of water, having been abandoned for some time. The reef apparently runs west 15 degrees north, and underlies at a high angle to south 15 degrees west. There is said to have been no gold in the reef. The country is a black fine-grained calcareous sandstone.

Turner's shaft, about 10 chains south of the Black Slates, is in diorite country. It is 110 feet deep. A band of black shale is said to have been cut at 15 feet. At 50 feet a reef was cut which is said to have been of no value. Below 50 feet no other reef was cut, and there was no change in the diorite country.

The Golden Horn on the head of Dry Bread Gully is a rock-bound vertical vein running west-south-west. It consists of half-an-inch to 3 inches of micro-crystalline cavernous ironstained quartz in diorite country. Some sandstone specimens were shown to me, with gold in the spaces between the crystals. About a hundred yards below the Golden Horn in the gully are some hardened quartzose sandstones and shales dipping at 45 degrees to the south-west under the diorite of the hilltop.

The Edith Mary Reef runs parallel with the head of Parson's Gully. The deep shaft (about 60 feet north of shaft *b*) cut the reef at 35 feet, and followed it for 103 feet on the underlie. Water was standing in it up to the timbering. Mr. T. H. Mills, one of the holders of the claim, informed me that gold was seen in sinking all the way down the shaft, and that the stone averaged 2 feet in thickness, being 3 feet thick where the reef was first cut, and the same thickness at the bottom. A collection of magnificent specimens, from 60 feet, was sent to the Colonial and Indian Exhibition. Some very fair specimens were shown to me. A cutting (*c*) on the left bank of the gully exposes the reef which runs north 5 degrees west and underlies at 75 degrees to west 5 degrees south. The reef at the south end of the cutting has 30 inches of quartz chiefly in interwoven crystals with occasional cavities among the converging apices of crystals. It has been sunk on here to the depth of 10 feet. I was informed that 2 ozs. of gold had been obtained from this part of the reef by pounding in a mortar. At the north end of the cutting the reef has 10 inches of quartz, and is "unformed," or, more correctly speaking, "deformed," having been disturbed and broken up in the process of denudation. Sixty feet north of the cutting a shaft (*a*) cuts the reef at 20 feet, and follows the underlie for 15 feet, the bottom being about on a level with the cutting. The reef has 3 feet 4 inches of quartz, on a well-defined foot-wall. The uppermost 6 inches are marked with dark clayey streaks parallel to the walls. The rest is irregularly seamed and crystalline. Another shaft (*b*) is 60 feet north of (*d*). It has been sunk 40 feet on the underlie of the reef. Specimens of gold were obtained from 25 feet down. Five or 6 ozs. of gold were obtained from a depth of 25 feet. The reef widens from 2 feet at the surface to 3½ feet, a few feet below where the water is standing. It is said to be 7 feet wide at the end of a drive 5 feet north of the bottom of the shaft. From the 30-feet level the ground has been sloped for 15 feet north of the shaft up to the surface. Fifty tons have been crushed from this stope, and 30 tons from the deep shaft, yielding (after the "specimens" had been picked out) 15 dwts. of gold. I saw some specimens of gold from the 35-feet shaft, the gold occurring in the quartz generally near the black streaks. The holders purpose to drive a level from the bottom of shaft (*a*) to shaft (*b*). I obtained very fair prospects from average samples of stone (in which no gold was visible) taken from shaft (*b*).

The following are the only records of crushings I have been able to procure. They extend over a period from June, 1882, to January, 1883. Returns of crushings do not appear to have been made by the Melbourne Company, which owned the machine till it passed into the hands of a London Company :—

	Tons.	ozs. gold.
Little Wanderer	185 ...	866
" "	100 ...	590
" "	136 ...	960
Wanderer Union (or East and West)	12 ...	42
Erratic Star	177 ...	199

A large quantity of alluvial gold has been obtained since 1881, when the diggings broke out in Nuggety Gully and Oaky Creek, between the Little Wanderer group of reefs and Mount Britton Township. Mr. C. Gibbard, manager of the Little Wanderer G.M. Company, accompanied me over the ground and pointed out the places where the large nuggets were obtained. These are marked on the accompanying map (No. 1).

Opposite the junction of the Little Wanderer Gully with Oaky Creek (*a* on map) nuggets up to 3 ozs. were found in the surface soil on a sloping alluvial "point." Below the soil are 10 feet of bouldery "wash," reticulated with veins of uncrystallised carbonate of lime. The wash was fairly payable. It rests on shales which dip to the west at 65 degrees.

Between the junction of Nuggety Gully and Oaky Creek (*b*) an 8-oz. nugget was found in the prospecting claim. No gold has been obtained in Oaky Creek above Nuggety Gully.

At (*c*) a party of Chinese got £60 worth of gold among large rounded boulders, on the right bank of Nuggety Gully, above a bar of diorite which crosses the gully below a flume which is here carried across the gully. Good wages were made above the flume, and still better success rewarded the workings below the diorite bar. Four men washed here 15 ozs. per week for some time.

From a little above the flume nothing payable was obtained to (*d*), where another diorite bar crosses the gully. Here a fragment of an old alluvial terrace remains on the left bank just below the bar.

Where the dray road crosses the gully at (*e*), a Frenchman got 60 ozs. of gold in shallow wash on the left bank.

At (*f*) one 45 oz. and one 69 oz. nugget were obtained on the left bank, and one 40 and one 50 oz. nugget were obtained above this on the right bank. One man obtained 350 ozs. on the right bank opposite Duffer Point. Above Duffer Point the gold was got from the bed of the gully

and

and not from the alluvial terraces, as was the case below. A nugget weighing 7 ozs. and another weighing 8 ozs. were obtained above the Old Iron public-house. A vein of limestone is seen on the slope above the old public-house running north-north-west and south-south-east.

At (*g*), above Duffer Point, a specimen (gold, with quartz attached) weighing 100 ozs. was obtained on a bottom of slate intersected with diorite bars.

At (*h*), on the left bank, a specimen containing 35 ozs. of gold lay on a slate bottom.

Above the northmost angle of Nuggety Gully all the gold obtained was more or less mixed with quartz.

The upper portion, generally 1 or 2 feet in thickness, of the alluvial gravel of Nuggety Gully is generally cemented with carbonate of lime.

To the east of the township of Mount Britton the higher hills are capped by a nearly horizontal deposit of volcanic ash which has evidently been laid down on a very uneven bottom. The ash is made up of fine dust, apparently the debris of a highly silicated porphyry, of which occasional large fragments occur in it. There is nothing except its superiority and obvious unconformability to the coal-measures rocks to indicate its age, but it may be conjectured tc belong to the Desert Sandstone Series, the base of which is often composed of similar volcanic dust. The bluffs yield large specimens of common opal and a jet black variety of opal which I have not seen before, and for which the name of "pitch-opal" would be appropriate. A story is current in the district about a gigantic diamond to be seen on rare occasions when the light is favourable about 40 feet from the top of an overhanging cliff. A miner whom I met in the West three years ago offered to lower me to the diamond by a rope, but I was deterred from accepting the offer by the recollection of the fable of the catspaw and the chestnuts, and by the consideration that many minerals besides diamonds glitter in the sun. It is quite probable, however, that careful prospecting might lead to the discovery of noble opals and other precious stones.

At present the principal alluvial gold diggings are carried on on the tributaries of Moonlight Creek, about a mile west of the Little Wanderer. In this locality some of the alluvial drifts bear no relation at all to the present watercourses. Messrs. Webley Brothers are working a deep drift on the top of a ridge. The gold (5 and 6 oz. nuggets) was got first in the surface soil at the foot of a ridge. The soil is only a few inches deep. A red subsoil of decomposed diorite has been left behind as worthless. The drift begins further up the ridge to the north. A shaft shows 3 feet of diorite boulders, on 1 foot of black shale débris, on 8 feet of red earthy or clayey wash with large boulders of diorite. In the latter one nugget between 60 and 80 ozs. in weight was obtained, and Perkins Brothers got 100 ozs. in a few feet of ground. A few feet further north-west gold was got below a "false bottom" of shale débris. Another shaft (Perkins') on the hilltop bottomed on the rock at 47 feet, passing through a "false bottom" of shale débris. A gutter of depression in the bottom filled with drift extended for 50 feet from Perkins' first opening to this shaft. Webley Brothers' shaft is on the same hilltop as Perkins', and 20 feet to the west. It is bottomed at 37 feet on black shales, which dip to the west. It passes first through 33 feet of coarse drift of diorite boulders with a finer gravelly layer in the middle. Next comes a layer of calcareous "cement," which is left for a roof, and has a clayey layer below. Beneath this is the auriferous drift (north-east of the shaft), which consists of 3 feet of large diorite boulders. In this nuggets occur from 3 dwts. up to 2 ozs. 7 dwts. The slate bottom is very uneven.

Horn's Gully heads from the ridge on which Webley Brothers' shaft is situated, and runs west-north-west. A 7-oz. nugget was found in the soil on the right bank of the gulley, 150 feet below Webley Brothers' shaft. A rich gutter ran for some distance down the gully (on a black shale bottom) from the place where the 7-oz. nugget was got. The drift on the right bank of the gully is loose and deep, and carries some gold, probably derived from the degradation of the drift on the top of the ridge.

Fifty yards down the gully, at Keely's tunnel, the drift is 10 feet deep, and rests on a bottom of shale. The gold is only found on the botton here. 24 dwts. were got from two feet of ground. This ground is in one of several fragments of a very ancient alluvial terrace, the top of which is perhaps 60 below the level of Webley Brothers' bottom.

In Paddy's Gully, which falls into the right bank of Horne's Gully, a 6-oz. nugget was found at 12 feet on a black shale bottom.

In Roberts' Claim, below Paddy's Gully, a 21-dwt. nugget had been found, just before my visit, in a film of clay resting on black shale.

The scarcity of fine gold and the sporadic occurrence of nuggets, both on Nuggety Gully and Moonlight, is very remarkable.

Near Mount Clarke is a group of reefs on which little work has been done as yet. South-east of the mountain are several likely-looking north-west and south-east reefs of cavernous crystalline iron-stained quartz. The country rock is hardened felspathic sandstone. East of the mountain several openings have been made by Mr. R. T. Horne, on veins of quartz with lead oxide, lead carbonate, and galena in hardened sandstone underlying diorite. Some large lumps of galena are said to have been assayed by Mr. K. T. Staiger, and to have given 130 ozs. of silver to the ton. Half-a-mile further to the north-west, a 10-inch reef underlies at 45 degrees to the south. The quartz is laminated and ferruginous, and carries a good deal of galena. The country rock is amygdaloidal diorite. I should not be surprised if the best part of the Mount Britton field should yet be found in this locality.

From Mount Britton I rode to Ewngella Station on the Broken River, to see a tin mine reported to have been discovered there. The locality in question is about two and a-half miles north-north-west of the station on a low hill. The lode runs north and south, and underlies at a high angle to the east. It contains from 12 to 18 inches of ore, a mixture of quartz blebs, mica, garnets, wolfram, and iron glance. The garnets may amount to about a fourth of the whole mass in volume, and in some cases appear to be pseudomorpns after cassiterite, to which they bear such a striking resemblance that it is difficult to realise that they are not tin ore. As wolfram is frequently associated with tin ore, and as the garnets may really have replaced tin ore, it is possible that the desired metal may actually be present in the lode at a depth. A zeolitic mineral (stillbite?) is abundant in the lode. About a mile to the east are several small reefs of quartz containing much iron and copper pyrites and carrying a small quantity of gold. The country rock is granite.

The

The track from Mount Britton to Ewngella passes by the Moonlight Diggings, east of Mount Robert and west of "The Stalk" (see Runs Map of Leichhardt District and Runs Map of North and South Kennedy, sheet 2). Just beyond Mount Robert fossils of the same species as those at Richards' were seen on the road. The dividing range between the Fitzroy and Burdekin waters on to a point five miles short of Ewngella Station is of diorite, with the exception of "The Stalk," a pinnacle of trachytic rock, possibly one of the vents from which the volcanic material of the bluffs in the neighbourhood of Mount Britton was ejected. Slates succeed the diorite and continue till about two miles north of Ewngella, where they are replaced by granite.

The Nebo road, between North Fort Cooper and Cooper's Creek, is carried over rich black soil downs, lightly timbered, or open plains (marshy flats). Little is seen of the underlying rocks, but ferruginous sandstones and grey shales (without igneous rocks) are met with at intervals as far as Fort Cooper Mountain, where some silicated felstone-porphyry is seen. From Cooper's Creek to Nebo the nature of the underlying rock can only be inferred from the fragments in the soil, which consist mainly of porphyry, with some of dolerite and a few of hardened sandstone.

My route from Nebo to Yatton took me by Tierawoomba, Collaroy, Cardowan, Lotus Creek, and Croydon Stations. (The country between Nebo and Collaroy, although included in the Leichhardt District, of which no large scale map has yet been published, is sketched on sheet 5 of the 2-mile map of Kennedy District.) The road and telegraph line from Nebo to Denison Creek traverse black soil downs and flats, on which amygdaloidal porphyrite occasionally comes to the surface. Near Denison Creek the outcrop of a quartz reef was seen heavily charged with brown hæmatite. For three miles beyond Denison Creek fragments of dolerite are seen at intervals. A mile further a low undulating country covered with fragments of an acidic felspathic igneous rock forms the divide between Denison Creek and the Funnel River. The road croses the Funnel River just below the mouth of Boothill Creek, and runs up the left bank of the latter nearly to Tierawoomba. The prevailing rock on this part of the track is a hard flinty pale-yellowish acidic felsite with blebs of quartz.

About 4 miles north-west of the junction of Tierawoomba and Boothill Creek a reef or lode 6 feet wide runs east and west. It contains a good deal of cavernous and ferruginous quartz, with steatite, carbonate of copper, a little ferruginous copper oxide ("tile ore"), and a little lead oxide. An assay by Mr. Heath, of Rockhampton, gave 25 ozs. of silver to the ton and a trace of gold. There are several similar lodes in the neighbourhood. The country rock is an acidic felsite.

For 5 miles east of Tierawoomba the Collaroy road crosses grey granite country. Just before coming to the divide between Tierawoomba and Murray Creeks is a singular conglomerate or agglomerate, probably of volcanic origin. Its matrix looks like an acidic felsite, and sometimes contains felspar crystals. The included pebbles are sometimes rounded and sometimes angular, and are composed of felsite and Lydian stone. They vary in size up to 8 cubic inches. The road runs down the left branch and the main Murray Creek as far as the southern boundary of "Tully" block. The hills on the eastern side of the road are mainly of acidic felsite, but porphyrite is seen occasionally in the valley. On the roadside, 2 miles north of the southern boundary of "Under Cliff" block (just north of an old tailing-yard), the cap of a strong lode runs north-north-west and south-south-east. Whatever it may cover it exhibits no oxides except that of iron.

Collaroy head-station is situated on a low hill, which is a "neck" or denuded core of an ancient crater, now filled up with an agglomerate composed of large angular blocks of porphyrite imbedded in a matrix of material, which is finer in grain though similar in composition.

From Collaroy to Cardowan the rock is mainly porphyry, with occasional masses of intrusive felsite.

On the road between Cardowan and Lotus Creek Stations (see Runs, Map of Leichhardt District) basaltic rocks occur in the valley of Connor's River for a few miles south of Cardowan. Porphyrite is seen about a mile north of the crossing of the Connor River. Three miles beyond the river I saw some silicified wood on the road. It is probable that some portion of the coal-measures extends from this place in the direction of the Funnel River. Six miles short of Lotus Creek hardened shales and green conglomerates dip to the west at 45 degrees. Thence to Lotus Creek the prevailing rock is porphyrite.

Croydon Station is in the northern part of "Bogus" block, on the left bank of the south branch of Lotus Creek (see Runs, Map of Leichhardt District). Plan No. 2, attached to this Report, was compiled by Mr. A. J. Richardson, District Surveyor, to show the position of Yatton Gold Field. This field occupies the greater part of the block marked as "Hillside" on the runs map. It is divided by a low watershed from the south branch of Lotus Creek, and drains into Yatton Creek, which is said to fall into the Isaacs River in "Longacre" block. The road between Croydon Station and the goldfield shows occasional outcrops of felsite, porphyrite, and volcanic breccia, or agglomerate.

A good deal of money has been expended wastefully in opening up this new field. It is only lately that systematic mining can be said to have had a commencement in the Yatton Prospecting Company's mines.

The Red Streak is a north and south reef which underlies to the east at 21 degrees. The country rock is diorite with decomposing dykes of silicated felsite, which, however, as seen in No. 1 shaft, only come down to the reef, but do not pierce the footwall. The reef probably displaces them, and may thus be inferred to occupy a line of fault or "slide." The reef averages 10 inches in thickness with a varying but generally very small amount of quartz (up to 6 inches wide). Veins of auriferous calcite and of decomposed concretionary carbonate of lime come down on the reef from above. Some of the stone, composed of mixed quartz and reddish, ferruginous carbonate of lime, shows gold very freely. There are also aggregations of decomposed orthoclase felspar in the quartz. The gangue-breccia contains a good deal of carbonate of lime. There are frequent blanks where no quartz is present in the reef. Three branches of "specimens" occurred in the reef, in a line as if shooting down across the underlie to the south. The gold is flakey, at times almost like gold leaf. The biggest lumps are in the softer "mullacky" portions of the reef. Others occur in the heart of the quartz and red calcite. The reef is cut at 38 feet in the main shaft, and followed on the underlie for 35 feet. It has been worked out for 30 yards at the lower levels, where streaks of copper pyrites, coated with sulphate of copper, make their appearance. The gold sells for £3 17s. per oz.

The Southern Cross is cut in a shaft on the east side of the Red Streak, which it intersects near the north end of the workings on that reef. Its course is north 30 degrees east, and its underlie west 30 degrees north at 80 degrees. It has a 3 to 7-inch vein of carbonate of lime on the hanging-wall at the 20-feet level, passing into quartz at the bottom of the shaft (40 feet). The total width of the reef, including gangue, is 3 feet. The gangue-stuff consists of broken-up diorite with films of iron oxide on the joints. These films are frequently auriferous. Gold is seen in quartz on the hanging-wall at 30 feet.

The St. Catherine Reef runs east 25 degrees north, and underlies at 55 degrees to south 25 degrees east. It is traceable on the surface for about 300 yards by outcrops of quartz. The main shaft, now 95 feet deep, is about 300 yards from the windlass shaft on the Red Streak. The reef, from hanging-wall to footwall, measures about 4 feet. The gangue stuff is composed of shattered and veined diorite. In the upper levels the upper portion of the reef contains a good proportion of quartz and some carbonate of lime. At the bottom there are 8 inches of quartz seamed and coated with steatite and accompanied by veins of calcite. There is a good deal of white iron pyrites in the casing. The reef has carried a small quantity of gold all the way down the shaft. Rich gold was got in the surface to the south-west of this shaft. A shallow shaft, 100 feet east 25 degrees north of the main shaft, shows 15 inches of quartz with reddish decomposed felspar crystals and some calcite and reddish carbonate of iron, and at least 3 feet of gangue stuff. A specimen found on the surface between this and the main shaft was sold for £70. As seen in No. 3 shaft of the Yatton P.C. at 38 feet, the St. Catherine Reef has 9 inches of stone, and is $2\frac{1}{2}$ feet in total width, 15 feet down on the underlie. At the face the quartz is clear, white, and crystalline, and is accompanied by decomposed felsite and calcite and blotches of copper pyrites. Some stone from this place gave excellent prospects. Gold can be seen in the "rubble" on the left-hand side of the underlie, 6 feet from the bottom.

In the north-west corner of the Yatton P. C., 150 yards north of the No. 3 shaft, a shaft has been sunk about 60 feet on a vertical vein running north-east and south-west, from which 40 ozs. of gold were got.

The Mountain Maid Reef is just north of the north-west corner of the Yatton P.C. It runs north-east and south-west with a steep underlie to the north-west. A whip had just been erected on a shaft on the left or east bank of Digger Gully. The shaft was, however, full of water. In a shaft further up the hill are seen 3 inches of quartz with red carbonate of iron and carbonate of lime. From the size of some blocks of stone in the heap, the reef must have been wider in places. The reef is shifted from one side of the shaft to the other by a vein of quartz and clay seam underlying to the south-east. I was informed that £100 worth of specimens had been taken from the whip shaft. Forty or fifty ounces of gold were got in a bend of the gully beside the Mountain Maid.

The Hidden Treasure is on the right bank of Diggers' Gully opposite the Mountain Maid. It contains several parallel veins of decomposed calcite underlying at 35 degrees or less to the south-east. These veins (half-an-inch to an inch thick) carried rich gold. One crushing of 10 tons gave 7 dwts. per ton, but I was informed that the holders made a living for some time by washing their stone. One lump of quartz, 20 feet down the underlie, contained gold.

The Emperor is on a branch of Diggers' Gully about a quarter of a mile north-west of the Catherine main shaft. It appears to have a north-east and south-west course. The three shafts on the reef were full of water. A leader is said to have prospected as high as half-an-ounce to the dish.

The General Gordon Claim lies a little over a quarter of a mile from the Hidden Treasure on the right bank of Gordon Gully. A shaft has been sunk 40 feet underlying to the north-north-west. A dyke of felsite, 18 inches wide, crosses the shaft from south-south-east to north-north-west. The gold seems to occur in a series of rock-bound leaders coming down against the felsite dyke. It is also occasionally seen in the felsite itself. It is possible that a main reef may be found along the side of the dyke. I was shown about 20 lb. of specimens which might be roughly guessed to yield half-an-ounce to the pound.

The Union Jack is about 50 yards east of the General Gordon. About 8 feet from the surface is a mullocky seam in 6 inches of stiff reddish clay-like putty, resting on decomposed felsite. The mullocky seam (felsite débris) is extraordinarily rich in gold. The gold is flakey, and is occasionally found adhering to thin films of quartz. Above the rich seam are some other seams of similar material traversed by veinlets of clay carrying gold.

The General Roberts is a continuation of the same deposit a few feet further north. I saw some good prospects washed out of the stuff.

The Iron Duke is on the north side of Mount Jost, about two miles north-east of the General Gordon. Little could be seen of it, as the shaft (26 feet deep) was full of water. The stone at grass is felsite, with bands of small white pyrites crystals. The deposit appeared, so far as could be judged from what was seen, to be not so much a fissure vein as masses of mineralised country rock.

The summit of Mount Jost is composed of a coarse conglomerate, with boulders (up to the size of a man's head) of porphyry in a matrix of finer material, though of similar composition. This conglomerate passes on the north-west side of the hill (the slope of which coincides with the dip) into a true quartz-porphyry, with a matrix of semi-crystalline silicated felspar and blebs of quartz.

I visited a scrubby hilltop 3 miles south-west of Yatton, where fossils were reported to be plentiful, and found the hill to be capped by a bed of grey limestone dipping south-south-east at 45 degrees. It was impossible to make out the relation of the limestone to the rocks of the goldfield, owing to the thickness of the scrub. The fossils observed were also disappointing, as I did not appear to have hit the right place. They were chiefly brachiopoda in bad preservation, and bore some resemblance to those of the Gympie beds. Mr. Macdonald, manager of the Yatton Prospecting Company, promised to make a collection, which may throw some light on the age of the goldfield.

Gold was first found on Yatton seven years ago, and 500 ozs. are said to have been then got by "gully-raking," but the working had to be abandoned on account of the drought. Messrs. Mackie and Keppest found a patch of "specimens" in one of the reefs in the prospecting claim in September, 1885. Payable gold was reported to the Warden on 24th March, 1886.

In

In the descent of the Coast Range between Killarney and Waverley Stations by the old road from Peak Downs to St. Lawrence, good sections are exposed of a great thickness of coarse green conglomerate. The sandy matrix and the boulders are of similar materials—mainly felsite and porphyrite—so that the conglomerate does not weather in the customary manner of conglomerates. The exposed surfaces, on the contrary, show the pebbles shorn off down to the same level as the matrix, so that it is only on a fresh fracture that the true character of the rock can be seen. In this respect the conglomerate resembles the conglomerate of Gympie.

From St. Lawrence I went in the Customs' cutter to Hunter Island in the Northumberland Group. The voyage was long and tedious owing to calms and the extraordinary currents which affect Broadsound. Our course afforded no glimpse of a few of the islands. In Long Island we saw a limestone bed dipping east at the level of the beach with shales overlying. The North Barren Island showed stratified rocks (? slates) dipping east. Red Clay Island has stratified rocks (? sandstone) dipping west at a low angle to the west.

Hunter Island (see Plan No. 3) is in longitude 149 degrees 9 minutes east and latitude 21 degrees 58 minutes south. It extends from north to south about a mile and a quarter, and has an average breadth of less than a quarter of a mile. It is well grassed, but the timber is confined to a few trees on the beach, among which are some hoop pines. The southern portion of the island is joined to the northern by a narrow neck or isthmus, and is wholly composed of granite. In the bay, on the eastern side of the neck, and in the wide portion of the island to the north a series of stratified rocks make their appearance. They have a north-and-south strike, and dip to the east at 65 degrees, being in all probability divided by a fault from the granite on the south. The uppermost (eastmost) bed seen is a white marble at the north end and a blue limestone at the south. Below this, to the west, comes a considerable thickness of highly contorted shales or slates with seams, nodules, and lenticular patches of coralline limestone. Next comes a thick bed of blue limestone, which graduates northward into pink marble. Sandstones and conglomerates underlie the bed last mentioned, and are best exposed in the bay on the east side of the isthmus. The last and lowest bed seen is at least 100 feet in thickness. On the east side of the isthmus it is an ordinary blue limestone. On the edge of the bay, to the north, its upper part is a white and its base a pink marble. Considerations of wind and tide made my visit to the island, in spite of the time consumed in reaching it, a very short one, and I had no time to search for fossils. There is no reason to doubt, however, that the limestones and other stratified rocks of Hunter Island are of the same age as the limestone of Marble Island ("Burdekin Beds" or Devonian). The northern end of Marble Island is composed of limestones, &c., and the southern end of granite, so that it is probable that here, as in Hunter Island, the stratified and platonic rocks are divided by a fault.

It is noticeable that the northern portions of the outcrops of the three large beds of limestone in Hunter Island have become changed from the usual type of blue-grey limestone into marble. There is no visible cause for this development of "regional metamorphism," but it is likely to be due to deep-seated igneous rocks or hydrothermal action. As the limestones, &c., were laid down subsequent to the formation of granite, and where seen at the southern part of the isthmus in closest proximity to it, are quite unaltered, it is evident that the latter can have had nothing to do with it. The western half of the northern portion of the island is composed of granite like its southern extremity, and it is probable that the stratified rocks were deposited on the granite long subsequent to its consolidation. A mass of diallage-rock is seen on the western shore of the island, apparently intrusive through the granite.

The limestone, of which there is an unlimited quantity, would serve admirably for a building stone or for the manufacture of lime. Some argillaceous portions would make hydraulic lime. The marble is minutely crystalline and pure white and quite fit for ornamental architecture or statuary. What I have above alluded to as "pink" marble is a very beautiful stone suffused with a faint blush-rose tint.

Two parallel quartz reefs occur in the granite of the northern portion of the island. They run west 40 degrees north, and underlie at 85 degrees to south 40 degrees west. On the northmost a shaft has been sunk 60 feet. The reef has 10 inches of massive white quartz on the hanging-wall. The next 8 inches are probably the only auriferous part of the reef, and consist of laminated quartz with ironstone films and iron pyrites On the foot-wall are 12 inches of white massive quartz. The southmost reef is 120 feet distant from the other. Here 18 inches of quartz lie on the upper side of a 2 feet diorite dyke. At the surface the quartz is cavernous and ferruginous. At the bottom of the shaft it contains a little copper pyrites. From the first shaft I was informed that half-a-ton of stone yielded 16 dwt. of gold, and 10 tons sent to the Crocodile Mill, near Rockhampton, were crushed with a total result of 16 dwt.

Having landed at the mouth of Scrubby Creek, where the horses had been sent on from St. Lawrence, we proceeded to inspect the Long Hill Gold and Silver Mine, which is situated on the south side of the creek on a spur of the Coast Range west, Selection No. 98 (see Plan of Westhills Parish, scale an inch to the mile). The chief feature of the workings is a tunnel driven 50 feet into the hillside south-south-east. The syenite country rock is here intersected by joints containing films or veins of pyrites. Some of these veins are said to have yielded an ore from which an argentiferous bullion was obtained by smelting. About 100 feet above the level of the tunnel a lode or mineralised belt is seen on the crest of the spur. The tunnel is designed to cut a lode on which several shallow openings have been made further up the hill on the crown of a ridge running north-west and south-east. If the lode is cut here it should have about 100 feet of "backs." The lode is first seen in two shallow shafts a little above the place where the tunnel should cut it, and has apparently a total thickness of about 15 feet. It consists mainly of a very coarse black brecciated gangue of hornblendic and siliceous material, with felsite and quartzite pebbles, and with bands resembling schist. Occasionally pieces of the breccia are highly quartzose and ferruginous, and some lumps, weighing 3 or 4 lb., have considerable quantities of carbonate of lead. The course of the lode is north-east and south-west, with a slight underlie to the south-east. About 70 yards further south-west are two old shafts, one of which is 22 feet deep. Here a vein of ore is 2 feet wide. It is a livid clay material with a small proportion of decomposed arsenical pyrites and carbonate and oxide of lead, and some ferruginous quartz. I assayed two samples of this on my return to Townsville. The first, consisting mainly of carbonate of lead and earthy impurities, gave 42 per cent. of lead and 19 ozs. 12 dwts. of silver to the ton. The second (a sample averaged from a

representative

representative collection of specimens of low-grade carbonate and oxide of lead with earthy impurities) gave 6 per cent. of lead and 5 ozs. of silver to the ton, besides a trace of antimony. If, as is probably the case, the silver is strictly in accordance with the proportion of lead in the ore, this is not so poor an assay as it may at first sight appear. In the same ratio per unit of lead an ore containing 70 per cent. of lead would yield 58 ozs. of silver per ton. About 70 yards further to the south-west a small paddock of ore shows quartz with lead carbonates and oxides. Mr. H. Varcoe, the manager of the tunnel claim, informed me that this ore assayed 28 ozs. of silver and 7 dwts. of gold per ton. The proportion of lead in the ore assayed was not stated. Mr. Varcoe showed me some samples which he had washed from the films of pyrites in the tunnel. One had a speck of native silver. He gave me specimens of bullion said to have been smelted from the pyritous veins in the tunnel. One of these was assayed by Mr. E. B. Lindon, of Brisbane, and gave 98·4 per cent. of lead, and 532 ozs. 9 dwts. 8 grs. of silver, and 1 oz. 8 dwts. of gold per ton.

West Hill Station is on the left bank of West Hill Creek, at the crossing of the Mackay and St. Lawrence road. About a mile and a-half north of the station stratified rocks belonging to the Carbonifero-Permian coal-measures make their appearance (see Plan of the Parish of West Hill, scale one inch to a mile). They consist of conglomerates, coarse grits, grey sandstones and ironstones, and probably represent the middle or marine subdivision of the Bowen River beds. They have a general dip to the north-west as far as Big Basin Creek. They extend northward to within a mile of the crown of the Mount Funnel Range, and although north of Big Basin Creek their dip is obscure; the probability is that they form a synclinal trough.

On a little unwooded hill near the beach, 3 miles north of the mouth of Marion Creek, is a small lode with stains of carbonate of copper and crystals of copper carbonate and silicate. The hill is composed of fine-grained hardened greywackes, which dip at a high angle to south-south-west. On the beach below this hill is a green conglomerate of great thickness, resembling that seen in the road cutting near Killarney, and evidently part of the same formation as the greywackes of the little hill.

A mile to the south, on the east side of Green Hill, near its north end (see Admiralty Chart), is a cupreous lode about 6 inches wide underlying at a high angle to south-south-west. It has greywacke on the hanging-wall side and shale on the foot-wall. I was informed that an assay by Mr. K. T. Staiger gave 12 per cent. of copper and 5 dwts. of gold per ton. A few feet up the hill the cap of a large ferruginous brecciform lode runs north and south. On the eastern side of the hill large blocks of brown hæmatite are seen. Above this is an altered cross-bedded sandstone, crystalline and like a porphyry, but recognisable on weathered surfaces. Sometimes it is a coarse siliceous grit, but in places it might be mistaken for a semi-vitreous felsite. Some shaley beds are altered almost to Lydian stone. On the summit of the hill blocks of iron-stained (brown hæmatite and ochre) felspathic lode-stuff lie on the surface. Colours of gold can be got in these blocks. Similar blocks can be traced down the hill to the south, but there is evidently no large lode, as the rock is so bare that were such present it could not fail to be seen. Further to the south a vertical 6-inch vein or lode of brecciform felspathic material with quartz and ironstone veins runs north-west and south-east; colours of gold were got in it. Lower still, and further south, near the mouth of a salt-water inlet, a small leader or vein has been cut in a trench. It underlies at 70 degrees to the south-west. It has 3 inches of quartz veined and laminated with brown hæmatite and 3 inches of ferruginous gangue. Colours of gold have been got in it.

At the mouth of the inlet the stratified rocks dip at a high angle to west-south-west. A block of ironstone, with quartz, found a little way up the inlet, assayed, I was informed, 4 ozs. 18 dwts. of gold per ton. A little higher, where a gully falls into the inlet, a dyke of decomposed yellow felsite runs south-west underlying north-west across the stratified rocks. The dyke is intersected with veins of ferruginous quartz, from which I got several fine "colours" of gold. One vein on the north-west edge of the dyke is 4 inches thick. A shaft, sunk on the north-west side of the dyke, cut a south-west reef or leader at 37 feet. The reef was 15 inches in total width, with quartz and ironstone, and a casing of felspathic gangue-stuff. As the shaft was full of water I could not see the reef, but I was informed that it gave fair, though hardly payable, prospects. A second shaft, 30 feet deep, was sunk 40 feet to the north-east. It cut a similar reef or leader running north-west and south-east, and giving colours of gold. About 30 yards further up the gully and on the opposite or left bank a third shaft, 23 feet in depth, in greywacke and shale country, cut at 10 and 18 feet, narrow dykes of yellow decomposed felsite running north-west and south-east and underlying to south-west. These dykes had veins of quartz up to 3 inches in thickness, the quartz containing specks and films of iron oxide.

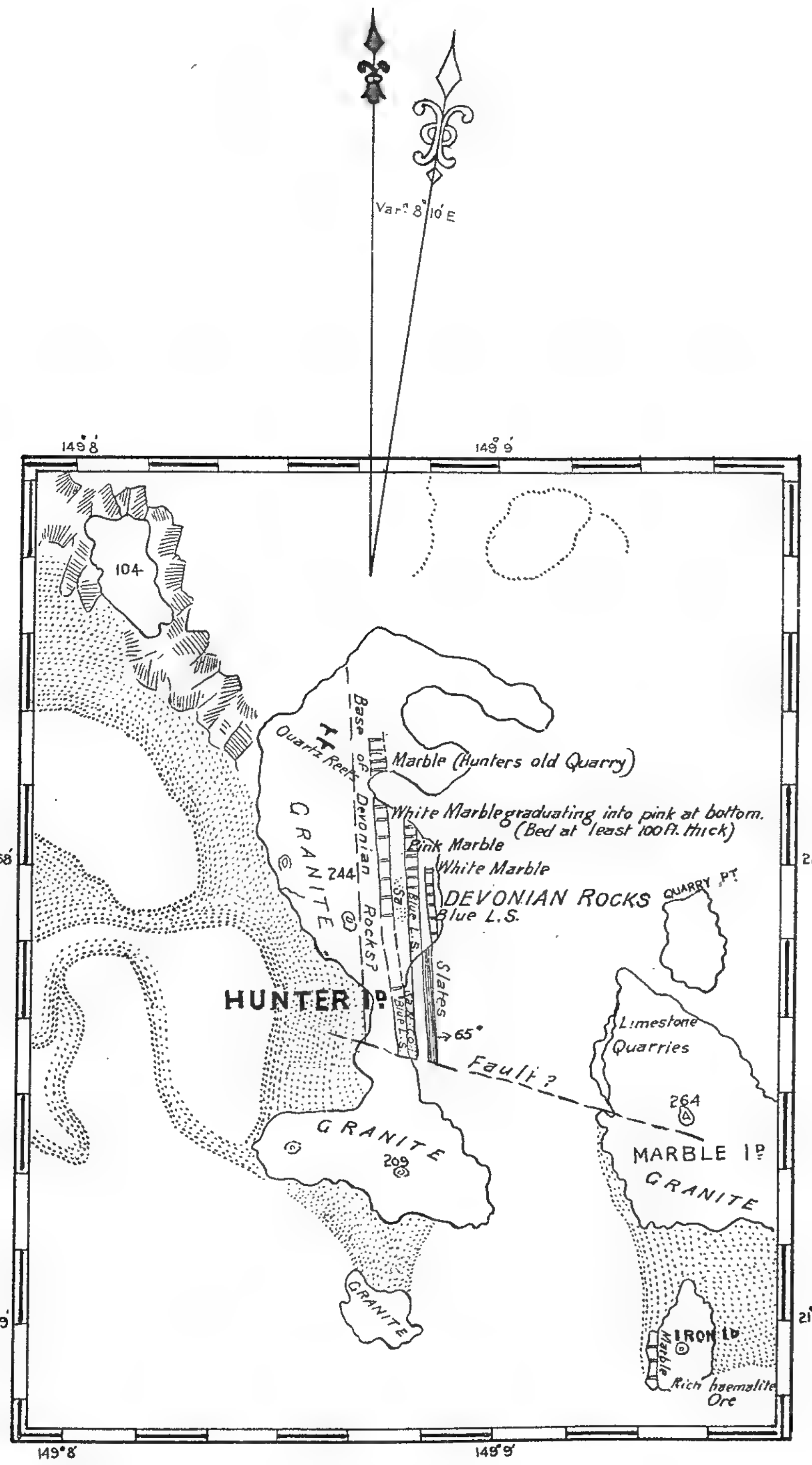
The axis of the Mount Funnel Range, where it is crossed by the Mackay and St. Lawrence road, is of a silicated felsite with quartz; blebs, conglomerates, coarse grits and sandstones, probably of the middle series of the Bowen River beds, again make their appearance north of the range in Rocky Dam Creek and the hills to the north. From Plum Tree Creek north-westward to Scrubby Mountain (see Two-mile Map, Kennedy District) the escarpment of the range is mainly composed of altered grits and conglomerates like those seen on the St. Lawrence and Peak Downs road near Killarney.

ROBERT L. JACK.

Geological Survey Office,
Townsville, 8th November, 1887.

Price 1s.]

By Authority: JAMES C. BEAL, Government Printer, William street, Brisbane.



PLAN No. 3

Sketch of Geology of

HUNTER ISLAND

To accompany

Report on the Geological Features of the Mackay District

By

Robert L. Jack

Government Geologist

1887.

PLAN No. I

M^T BRITTEN GOLDFIELD

To accompany

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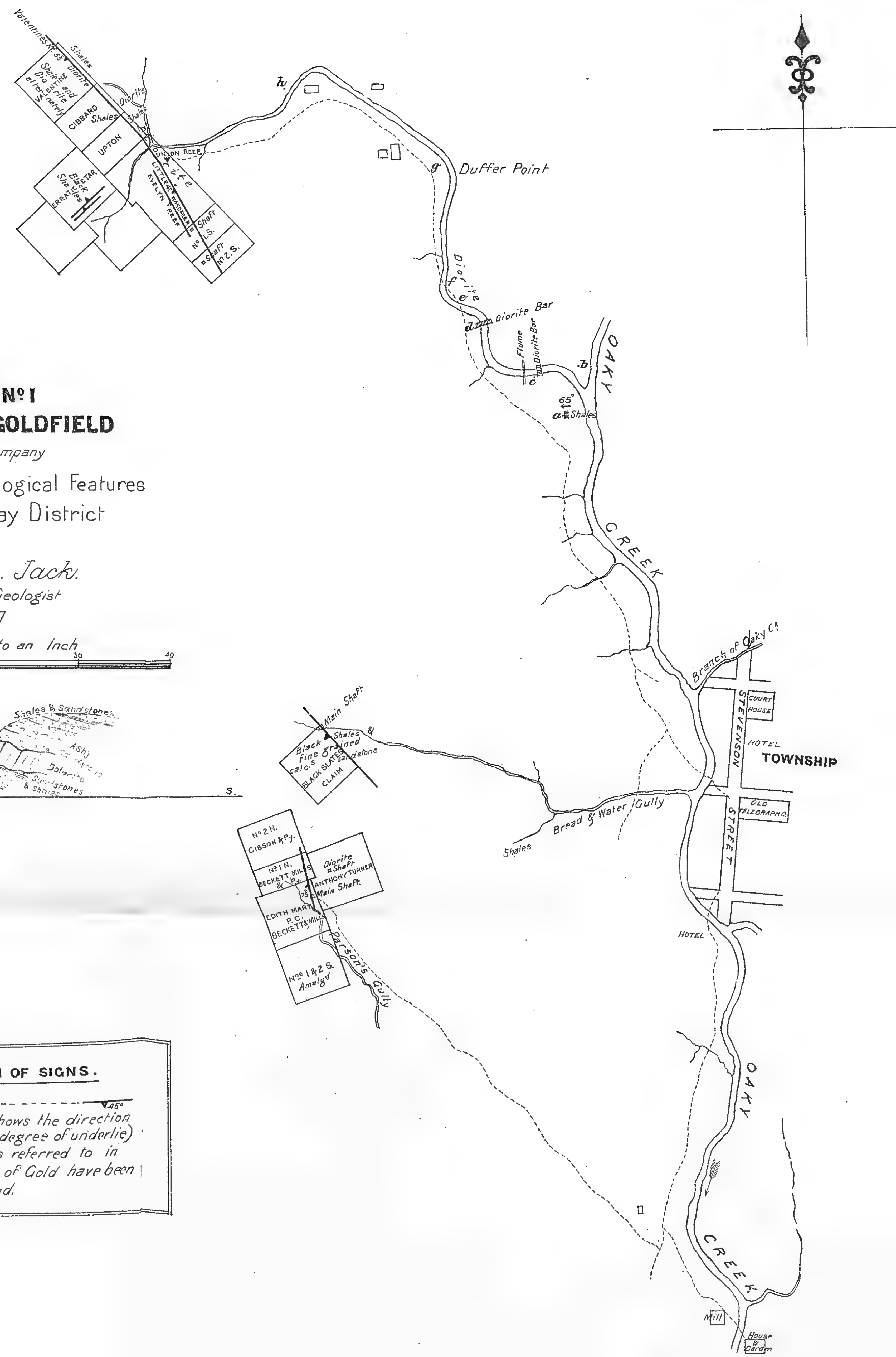
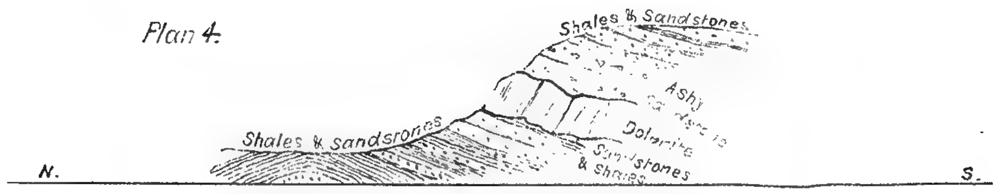
1887

Scale 10 Chains to an Inch

0 5 10 20 30 40

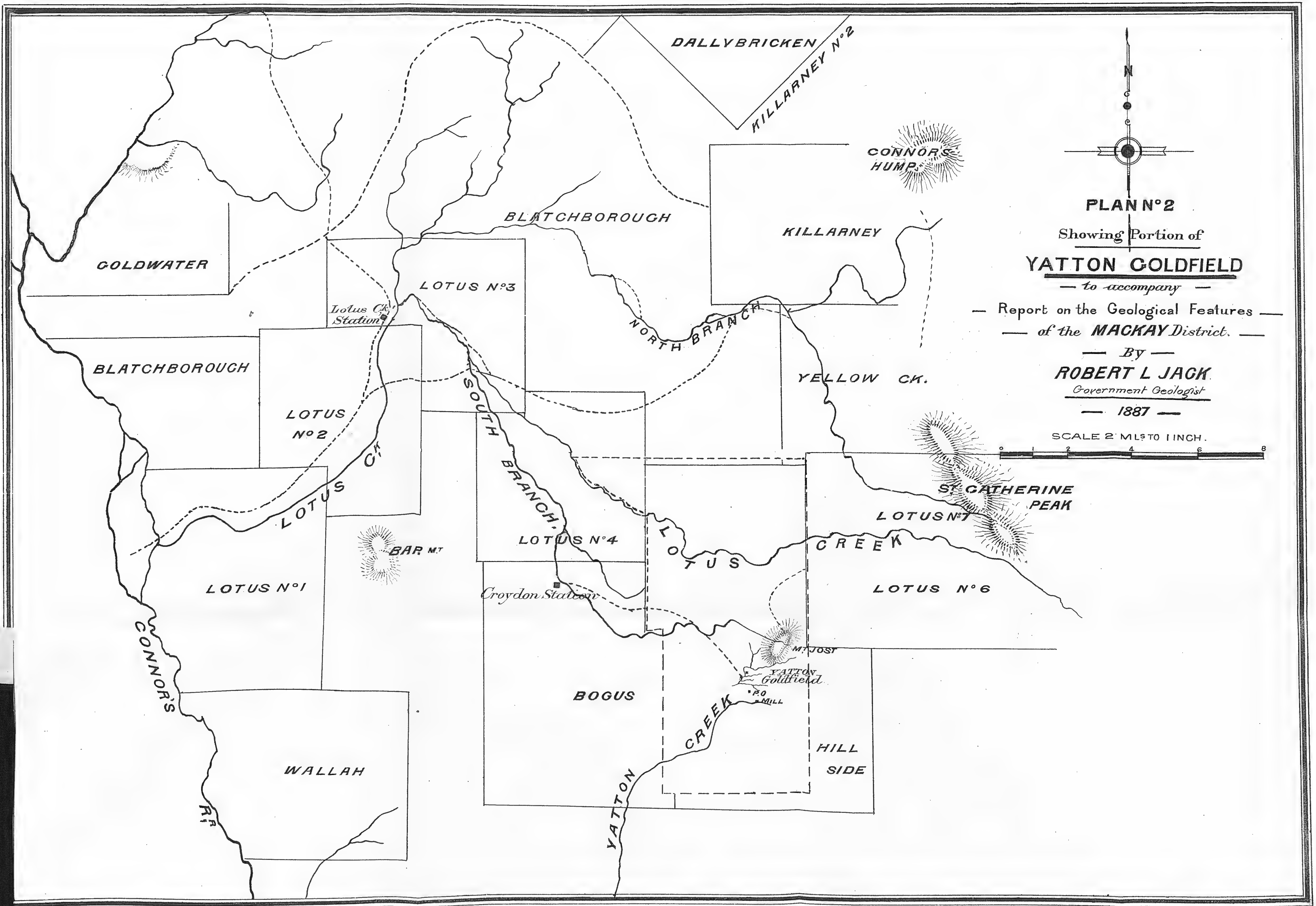


Plan 4.



EXPLANATION OF SIGNS.

Reefs ---------------- 45°
(The black triangle shows the direction and the figure the degree of underlie)
***a, b, c** & c. Localities referred to in Report where nuggets of Gold have been found.*



PLAN N°2
Showing Portion of
YATTON GOLDFIELD
— to accompany —
— Report on the Geological Features —
— of the MACKAY District. —
— By —
ROBERT L JACK
Government Geologist
— 1887 —
SCALE 2 MLS TO 1 INCH.
0 1 2 4 6 8
N
DALLYBRICKEN
KILLARNEY N°2
CONNOR'S HUMP
KILLARNEY
BLATCHBOROUGH
GOLDWATER
LOTUS N°3
Lotus Ck. Station
NORTH BRANCH
BLATCHBOROUGH
LOTUS N°2
YELLOW CK.
SOUTH BRANCH
LOTUS CK.
ST. CATHERINE PEAK
LOTUS N°7
BAR MT.
LOTUS N°4
LOTUS
CREEK
LOTUS N°1
Croydon Station
LOTUS N°6
CONNOR'S
MT. JOST
YATTON Goldfield
P.O.
MILL
BOGUS
CREEK
HILL SIDE
WALLAH
RR.
YATTON

1888.

QUEENSLAND.

LIMESTONE DISTRICT, PART OF THE PALMER GOLDFIELD.

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Presented to both Houses of Parliament by Command.

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The "South Cross" lies west of the Anglo-Saxon, from which it is divided by a hill. Its course is north 15 degrees west and its underlie to west 15 degrees south at 65 degrees. In a shaft sunk 28 feet on the underlie I saw on a well-defined footwall 8 inches of laminated quartz, 2 to 7 inches of slaty gangue, 3 inches of quartz, and about 18 inches of slaty gangue. I saw several specks of gold in the heap of stone raised from the shaft. The joints of the quartz are frequently coated with manganese. Average samples of the lower (8-inch) vein of quartz gave fine "colours" of gold. Some stones gave good prospects of fine gold.

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The "Good Hope" is a very noticeable reef. Its cap runs east and west up the slope of a hill about half-a-mile north of the Anglo-Saxon underlie to the south at 75 degrees. At the east end it is 4 feet thick, and stands 10 feet out of the ground. There were two shafts on the claim, the westmost 10 feet deep and another 150 feet to the east 60 feet deep. From the latter a drive had been made 80 feet to the west. Between the two shafts the total width of the reef was in places 15 feet, with a 4-feet vein of quartz on the south and a 3-feet vein on the north side. The quartz encloses blocks of bluish quartzite, fragments of slate and greywacke, and spots of arsenical pyrites. In descending the 60-feet shaft the uppermost vein of quartz was seen to average 2 feet in thickness, although it pinched at the depth of 50 feet. It carried gold, especially on the west side of the shaft, from 30 to 50 feet. A level had been driven westward for 80 feet from the bottom of the shaft, mainly on the footwall reef, the hanging-wall reef being only touched in short cross-cuts to the south near the face of the level. The hanging-wall reef is better than the other at this level. The gold appeared to shoot down at a low angle to the west and occurred in large patches. I got very good prospects of coarse gold from some stone taken from the level.

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Geological Survey Office,
Townsville, 18th April, 1888.

Price 1s.]

By Authority: JAMES C. BEAL, Government Printer, William street, Brisbane.

1888.

QUEENSLAND.

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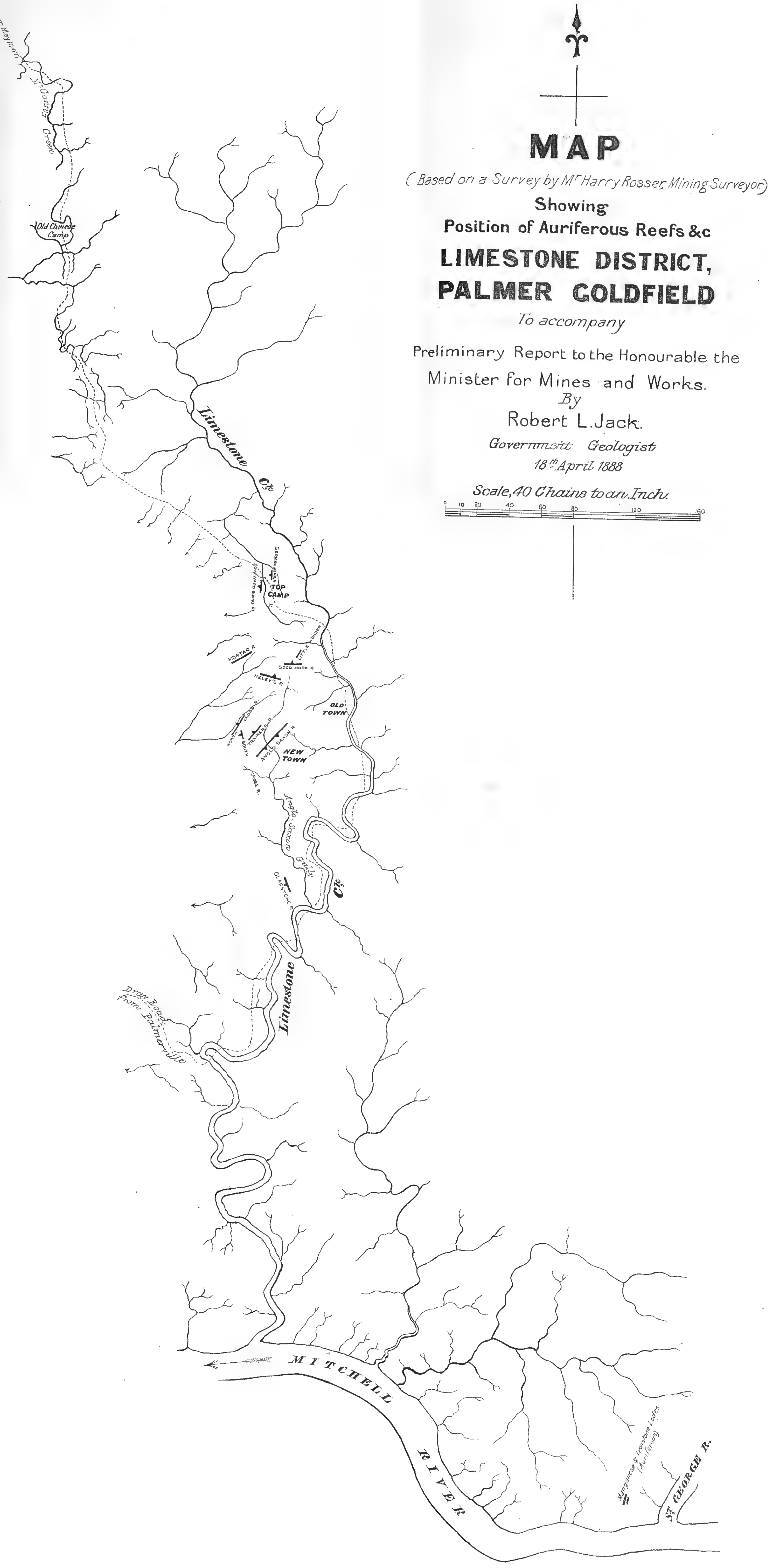


MAP
(Based on a Survey by Mr Harry Rosser, Mining Surveyor)
Showing
Position of Auriferous Reefs &c
LIMESTONE DISTRICT,
PALMER GOLDFIELD
To accompany
Preliminary Report to the Honourable the
Minister for Mines and Works.
By
Robert L. Jack.
Government Geologist
18th April 1888
Scale, 40 Chains to an Inch.
0 10 20 40 60 80 120 160
To Maytown
McGanns Creek
Old Chinese Camp
Limestone Ck.
German Miner
Homeward Bound R.
TOP CAMP
Little Wonder
Mortar R.
Good Hope R.
Heley's R.
Old Town
North Cross R.
South
Trainers R.
Anglo Saxon R.
New Town
Cross R.
Anglo-Saxon Gully
Gladstone R.
Ck.
Limestone
Dray Road from Palmerville
MITCHELL RIVER
Manganese & Ironstone Lodes (Auriferous)
St. GEORGE R.

1889.

QUEENSLAND.

MOUNT MORGAN GOLD DEPOSITS.

(SECOND REPORT BY ROBERT L. JACK, GOVERNMENT GEOLOGIST.)

Presented to both Houses of Parliament by Command.

TO THE HONOURABLE THE MINISTER FOR MINES AND WORKS.

Since the publication of my Report on the Mount Morgan Gold Deposits in 1884, the development of the mine has rendered it desirable that a further examination should be made.

The following is an account of the mine as it appeared at the beginning of November last. I must record my indebtedness to Mr. Lisle, the manager, for his trouble and patience in guiding me over the various workings and explaining their objects and results, and to Mr. Wesley Hall, the managing director, for the facilities he afforded me in making my inspection. The information herein given regarding assays from different portions of the mine was given to me by these gentlemen, who placed the results of their labours frankly and courteously at my disposal, and I have no hesitation in accepting their figures. To verify them would employ an assayer for some years. The unparalleled richness of the mine must be obvious to the most casual observer.

No. 1 *Floor* is an insignificant remnant (shortly destined to disappear) of the floor of what was referred to in the first Report as No. 1 Quarry, which cut into the hill about 25 feet below the summit. The southern face of this excavation was thus described:—

"The central portion is a large mass of brown hæmatite ironstone, generally in great blocks (up to some tons in weight) with a stalactitic structure, as if the iron oxide had gradually filled up cavities left in the original deposits. The ironstone contains gold of extraordinary fineness, which, however, after a little practice can be detected in almost every fresh fracture. The ironstone is more or less mixed with fine siliceous granules. Gradually to right and left of the central mass the silica more and more replaces the ironstone. It is a frothy, spongy, or cellular sinter, sometimes so light from the entanglement* of air in its pores that it floats in the water like pumice. Fine gold is disseminated throughout this siliceous deposit as well as in the ironstone. Near the west end of the cutting is a vertical dyke of kaolin mixed with fine siliceous granules, passing into pure kaolin with some silicates of magnesia, including a fine variety of French chalk."

No. 2 *Floor.*—With the exception of the fragment of No. 1 Floor above mentioned and two triangular fragments to the east, the auriferous portion of the mountain top has now been reduced to the level of No. 2 Floor—35 feet below No. 1. The kaolin dyke referred to in the description of No. 1 cutting crosses the south-western portion of this floor from north-west to south-east, and bounds the auriferous portion which is confined to the north-east side of the dyke.

The following description of No. 2 Face and the other excavations will be understood by reference to the italic letters on Plan B:—

(*p*) North face of south-eastern fragment.—The easternmost 20 feet rather compact, only slightly vesicular silica, stained black with iron oxide. Then large lumps of black ironstone with cavities filled with stalactites. Thence to the north-west corner of the fragment large angular blocks of siliceous sinter with only a little iron oxide.

(*q*) West face of same fragment.—Large angular blocks of siliceous sinter with only a little iron oxide in a ferrugino-siliceous matrix.

(*r*) South face of north-east fragment.—Rough frothy siliceous sinter in large angular blocks at east end of face. Above the mouth of the main shaft (239½ feet from No. 2 Floor to No. 1 Tunnel) a pipe of red and yellow ferruginous earth runs among the blocks which are comparatively small in the vicinity. Immediately west of the shaft, large blocks of iron-stained sinter and ironstone. About 10 feet west of shaft some vertical pipes of yellow ferruginous earth. From this to the south-west corner of the fragment large blocks of ironstone, often with brilliant iridescent colours, with open cavities and stalactites. The ironstone has a good deal of silica mixed with it. The stalactites in the cavities are vertical except where the blocks have evidently been disturbed from their original position. Gold shows freely in the ironstone and even in the heart of some pure limonite.

(*s*) West face of same fragment.—Ironstone similar to that last described but getting more and more siliceous to the north.

(*t*) West wall of No. 2 Floor.—Kaolin dyke bounding the auriferous deposit (on this floor) to the south-west.

(*u*) Yellowish-white

* Misprinted "enlargement."

(*u*) Yellowish-white siliceous sinter, with not much gold.
(*v*) Ferruginous red and white kaolin dyke, containing a little gold.
(*w*) Black iron-stained sinter (good).
(*x*) Coarse-grained siliceous sinter, the uppermost 3 feet iron-stained and cavernous.
(*y*) Kaolin dyke.
(*z*) Black iron-stained sinter (good).
(*za*) Black iron-stained sinter, with two "heads" underlying at 65 degrees to the south-east.

No. 3 *Floor* is 35 feet below No. 2. The following are notes on the appearance of No. 3 Face:—

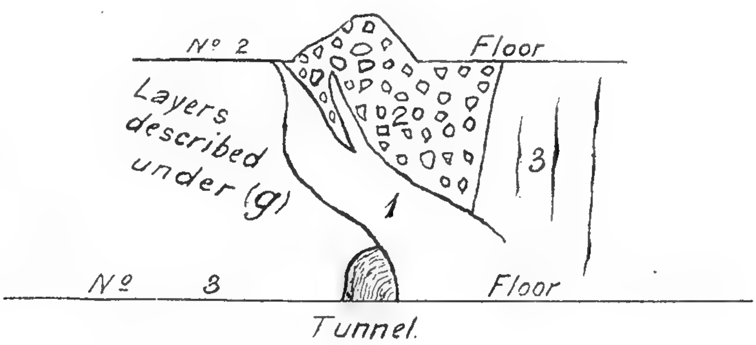
(*e*) On west side of the "Kaolin dyke".—Ferruginous siliceous sinter (not rich).

(*f*) Ferruginous sinter or iron-stained silica clinging to dyke (good).

(*g*) On the top, 5 feet of white sinter, not rich; on 8 feet of bouldery quartz black with iron oxide; on 10 feet of ferruginous silica, of which the upper half is very rich, sometimes giving 700 oz. gold per ton. These materials are rudely arranged in layers which incline slightly to the east.

(*h*) Yellow decomposed limonite running north-north-west, and underlying at a high angle to east-north-east. In No. 3. Face it is as much as 15 feet wide, and rich in gold. Traced across No. 3 Floor it becomes much narrower. In the face the materials last described (*g*) dip towards the limonite streak, and become yellow as they approach it.

(*j*)



1. The yellow limonite (*n*), rich in gold.
2. Black siliceous ironstone in large boulders, with stalactites, not very rich.
3. Red ferruginous silica, with vertical limonite veins, gradually becoming yellower eastward. Fairly good stone.

(*k*) Agglomerate of large angular porous bombs of sinter, with a yellow siliceo-ferruginous matrix; full of vertical veins of decomposed limonite; resembles a volcanic agglomerate: more gold here in the matrix than in the stones.

(*l*) In the bottom of the face at angle between the east and west and north and south portions, livid ferruginous sinter; not rich. Above this and to the south is ironstone in large angular blocks, arranged with a tendency to dip into the face to the east.

(*m*) Boulders of ironstone weathering out of a decomposed ironstone matrix. Good for about 3 oz. per ton.

(*n*) Fine white siliceous sinter (continuous with that in the old Magazine on No. 4 Floor), with a red felspatho-ferruginous rock on east side.

(*o*) Yellow decomposed coarse-grained siliceous sandstone or grit.

No. 4 *Floor* (the "No. 2 or Magazine Quarry" of my previous report), 35 feet below No. 3 Floor. The whole of this floor except the "fine white siliceous earth" in the Magazine (*vide* previous report) contained rich gold. The face remains as it was at the date of my former visit, when it was thus described:—"The lower or Magazine face presents a sort of fan-like arrangement of its various materials. In the centre is a band (almost vertical) of brown hæmatite in large 'bombs' with a mammilated botryoidal or sometimes reniform appearance (*i*). To the right (east) is a nearly vertical deposit of aluminous iron-ochre (*h*) followed by a mass (still nearly vertical) of red hæmatite in large cellular bombs (*g*). To the east is a broad mass of loose iron-stained siliceous and aluminous material (*f*) which begins to lean eastward like the outer feathers of a fan. A great mass of loose earthy red hæmatite (*e*), another of brown hæmatite weathering to iron-ochre (*d*), another of red earthy hæmatite (*c*), and another of brown hæmatite in large (ton) blocks (*b*) appear in succession as the cutting is followed to the east. The Magazine (near the east end of the cutting) is excavated in a fine white siliceous earth, and the cutting ends with a mass of soft earthy aluminite. Beginning from the west side of the nearly vertical mass of brown hæmatite (*i*) first described, we have in succession, in going westward, a band of yellow ochre (*j*), a broad belt of light siliceous sinter (*k*) ironstained, and containing some angular fragments of the quartzite of the country rock, the members of the series leaning more and more fan-fashion to the west as they recede from the central vertical bands. At the end of the cutting is a mass of magnesian and aluminous silicates, which is probably the prolongation of the dyke seen in the upper quarry." [The probability referred to in the latter paragraph has been rendered a certainty by the recent workings.]

No. 5 *Floor* is only 14 feet below the level of No. 4 Floor. In No. 5 Face are seen:—

(*c*) Dyke of yellow silicated felstone, referred to in its weathered portions as a "Kaolin Dyke," traceable from No. 5 Face to No. 2 Face, and south-westward for some distance beyond the auriferous rocks. In the latter direction it becomes red and yellow, ferruginous, and cavernous. In No. 5 Face, opposite the wire tramway loading-shed, the edge of the dyke passes in places into siliceous brown or yellow hæmatite.

(*d*) Auriferous silica for about 10 feet south of the dyke; thence southward to the mouth of No. 2 tunnel, siliceous and felspathic rock, red and livid with iron oxide—less rich.

So far as the surface excavations show, the auriferous deposits are bounded to the south-west by the large felstone (or "kaolin") dyke on No. 1 and No. 2 Floors; but on No. 3 and No. 5 Floors the dyke intersects the auriferous deposits, some portion of the latter being found on its south-west side. On the north-east side the whole hill to the level of No. 2 Floor has been proved to be auriferous, and, indeed, has for the most part been excavated. In No. 3 and No. 4 Floors the eastern limit of the auriferous deposit has been touched. It now remains to be seen what light the underground explorations throw on the extension of the deposit.

No. 2 Tunnel (see Section D) is driven north 10 degrees east from the south side of the hill to the north side, commencing at the south-west corner of No. 5 Floor; and thus at a level of 84 feet below No. 2 Floor. For a distance of about 120 feet from the south end the tunnel cuts through the "deposit" (using the term as distinct from "country-rocks"). The deposit may be described as a porous siliceous material, sometimes a good deal ironstained and sometimes occurring in boulder which are enveloped in red ferruginous coats. The ferruginous material occurs also in veins and "vughs." At 120 feet the felstone dyke so often alluded to crosses the tunnel. Near the dyke the siliceous deposit gives off an efflorescence of alum, and in a few places it contains free hydrochloric acid. I was informed by Mr. Lisle that 30 feet from the south end of the tunnel an assay of red ferruginous material gave 17 ozs. of gold to the ton, and colours were obtained from that point to the south end. The auriferous deposit is thus proved to extend down the hill (in the line of No. 2 Tunnel) from the edge of No. 2 Floor to the mouth of the tunnel.

The felstone dyke as seen in No. 2 Tunnel is about 26 feet wide and sends off one vertical vein to north-north-east and another to south-south-west.

From the dyke northward for 210 feet the tunnel intersects a light siliceous sinter, with occasional ferruginous "vughs" and veins, and (especially near the felstone dyke) stringy veins of felstone, probably emanating from the dyke. At the north end the sinter, although not by any means bedded, has a sort of arrangement suggestive of a dip to the south. A mass of felstone occupies the northmost 130 feet of the tunnel. Between this and the felstone dyke already referred to the sinter contains a little gold all the way.

No. 2 Tunnel is more or less auriferous in its whole length, except where the siliceous deposit is interrupted by felstone dykes.

A short branch tunnel to the south-east connects the main tunnel with No. 5 Floor opposite the end of the wire tramway loading-shed, and runs mainly along the course of the felstone dyke.

A second branch tunnel (see section E) commences 220 feet from the south end of No. 2 Tunnel, and runs east till it comes out on the hillside at a distance of 310 feet. This branch is crossed 16 feet from the main tunnel by a felstone dyke (18 inches wide), probably the same which was noted as leaving the large dyke further south in the main tunnel. As far east as this dyke, and a little beyond, the sinter is a good deal stained with iron oxide. Thence onward to the east the sinter is nearly white. For about 136 feet from the main tunnel the branch (with the exception of the narrow dyke) intersects light soft siliceous sinter in which, according to Mr. Lisle, gold varied from 1 oz. 2 dwts. to 32 oz. per ton. Sixty-two tons treated gave a return of 5 oz. 6 dwts. gold per ton. At 216 feet from the main tunnel the siliceous sinter is a good deal mixed up with silicate of alumina; and thence eastward, although it loses the silicate, it has a tolerably distinct dip east at about 25 degrees and is poor in gold. Towards the east end the sinter becomes again more ferruginous, till in one place it is a mass of black ironstone boulders, pretty rich in gold. A white siliceo-felspathic material, enclosing elongated nodules of pure silica and containing some free hydrochloric acid, at the mouth of the tunnel, has a rude dip of about 60 degrees down hill (east) and may be partly surface-wash.

The *Freehold Tunnel* (see section F) commences at the top of the double-line tramway, and is driven W. 30 degrees N. for a distance of 789 feet till it strikes the main shaft 206½ feet below No. 2 Floor, and 122½ below the level of No. 2 Tunnel. For the first 180 feet the tunnel traverses a decomposing felspathic crystalline rock, like rhyolite. The next 40 feet are in compact, massive pyritous quarzite. The next 80 feet are in dolerite. To this succeed 30 feet of a decomposing basic crystalline rock (dolerite), 20 feet of decomposed felspathic red and black ferruginous rock, which exudes sulphate of magnesia (dolerite), and 42 feet of decomposing felspathic yellow rock (dolerite). Beyond this point (392 feet from the mouth of the tunnel) and on to the main shaft the tunnel intersects (with the exception of a felstone dyke 482 feet from the mouth) fine light siliceous sinter impregnated in places with brown hydrous iron oxide. For the first 11 feet the sinter assayed for 7 oz. 6 dwt. of gold per ton. Gold continued for 49 feet further, but was not so rich. At 525 feet from the mouth about 8 feet of the sinter in the floor of the tunnel assayed for 6 oz. of gold to the ton. From this point to the shaft Mr. Lisle says there was no free gold. A little pyrites can be saved in the dish on washing the sinter.

From the main shaft a southern crosscut runs 237 feet from the main freehold tunnel in a south-south-west direction (see section G). It is connected at the south end with a shaft 122½ feet up to No. 5 Floor and 33 feet down No. 1 Tunnel. For 138 feet from the main shaft an exceedingly light soft white siliceous sinter, without gold, is traversed by the tunnel; then a narrow felspar dyke is crossed, underlying to the south. After 48 feet of rather compact silica the felstone dyke which bounds the auriferous deposit on the south-west side in No. 2 Floor is again met with; it is here 19 feet wide, and forms the limit of the sinter. Between it and the south end of the tunnel only the quartzite of the country rock is seen.

No. 1 Tunnel (see section H) is driven from the hillside north 10 degrees west for a total distance of 1,070 feet. At 259 feet it is cut by the shaft from the No. 5 Floor at a depth of 155½ feet. Sixteen feet beyond the shaft the "Western Crosscut" is driven west 15 degrees north for 228 feet. About 208 feet further the "Eastern Crosscut" runs east 7 degrees south, and connects, at 110 feet, No. 1 Tunnel with the main shaft. An air shaft, 123 feet deep, comes down to the tunnel at 170 feet from the north end. Crossing the line of No. 2 Tunnel (155½ feet deeper), between the "Eastern" and "Western" crosscuts, at an angle of 20 degrees, No. 1 Tunnel is remarkable for the complete contrast it presents to No. 2.

At the mouth of the tunnel, and for 90 feet in, the "country-rock," of hard, somewhat pyritous quartzite, is seen. For the next 42 feet a similar quartzite is mixed with decomposing pyrites and occasional serpentine. Then comes a dyke, 1 foot in thickness, of decomposing felstone or kaolin, under-

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lying to the south-east. The next 67 feet are of highly pyritous quartzite (more pyrites than quartzite) intersected by several narrow north-north-west felstone dykes. Beyond this point a good deal of sulphate of copper weathers out of the pyrites. Cupreous pyrites and quartzite continue to 12 feet from the shaft sunk from No. 5 Floor. Here commences a mass of yellow decomposed felstone which continues for 10 feet beyond the shaft. After about 20 feet of a quartzose rock (quartzite), full of pyrites, the felstone dyke which bounds the auriferous deposit on No. 2 Floor is again met with and occupies the next 21 feet of the tunnel. A quartzose rock full of fine pyrites is traversed for the next 37 feet, when a dolerite or rhyolite dyke is cut. The direction of this dyke is uncertain, as the tunnel is here timbered up. From this dyke to the eastern crosscut is a sometimes siliceous, sometimes felspathic rock, highly pyritous. From the eastern crosscut the tunnel traverses 345 feet of quartzite, highly pyritous and cupreous, especially to the north, and intersected by a few small felstone dykes. Then about 25 feet of silica, brown with iron oxide, which assayed for 3 ozs. gold and 3 ozs. silver per ton. This was the only auriferous rock in the tunnel. Thence to the inner end of the tunnel was a mass of basic felspathic crystalline rock (dolerite ?).

The Eastern crosscut from No. 1 Tunnel (*see Section J.*) traverses (except at its east end, under the main shaft, where a felstone dyke with a low underlie to the south-west is seen) a "country-rock" of somewhat compact quartzite, occasionally porous, without much pyrites. (No gold.)

The Western crosscut (*see Section K.*) cuts through a fine white pyritous kaolin for the first 37 feet, and next through a dolerite. Thence to the western end the crosscut traverses either solid fine-grained pyrites or quartzite with pyrites. Mr. Lisle informed me that the pyrites contained no payable gold.

The *Sunbeam Tunnel* (*see Plan A.*) commences on the left bank of Hall's Gully, about a-quarter of a mile from the summit of Mount Morgan, and is being driven on a course E. 17 degrees N. towards the main shaft, which it will strike at a considerably lower level than that of No. 1 Tunnel. The first 170 feet of the tunnel are in a rhyolite dyke, shown in the map attached to my former report as running south-eastward across the Company's leaseholds and the south-west corner of their freehold. The dyke has a low underlie to the north-east, and is also cut by the "Rip and Tear" Tunnel on the western side of the fence dividing the freehold from the leasehold properties. The rest of the Sunbeam Tunnel, so far as yet driven (58 feet), is in hard fine-grained pyritous quartzite.

The various tunnels throw considerable light on the boundary line between the auriferous deposit and the "country-rock."

The southern portions of No. 1 and No. 2 Tunnels and the southern crosscut from the Freehold tunnel are sufficiently near the same line to permit of comparisons being made which will give us an approximate idea of the limits of the auriferous deposit in their neighbourhood. From section L, along the course of a portion of No. 1 Tunnel, it will be seen that the deposit, which is more or less auriferous in the various excavations and as far south as the mouth of No. 2 Tunnel, commences in the south branch of the Freehold Tunnel, about 50 feet north of the shaft sunk from No. 5 Floor, and is not seen at all in the No. 1 Tunnel, only 35 feet below. It may be interesting to compare the approximate boundary line between the auriferous and non-auriferous rocks, arrived at from the above data, with the ideal boundary line shadowed forth in the sketch on page 4 of my former report.

Again, the Eastern crosscut from No. 1 Tunnel to the main shaft comes sufficiently near the line of the eastern branch of No. 2 Tunnel to enable their sections to be compared with advantage, while both are crossed nearly at right angles by the Southern crosscut from the Freehold Tunnel. Section M is taken along the line of the Eastern crosscut from No. 1 Tunnel.

On the northern side of the hill the No. 2 Tunnel fails to define the north-east limit of the auriferous deposit, and it ends in a mass of felstone, which is as likely as not to have had the auriferous deposit on the north side, had the denudation of the hill not removed it. The underlying No. 1 Tunnel, on the other hand, has penetrated much further to the north without cutting anything of the auriferous deposits met with on the top of the hill.

The Eastern crosscut from No. 2 Tunnel continues the auriferous deposit to the hillside, 310 feet east of the main tunnel.

The Freehold Tunnel shows gold as far as 397 feet east 30 degrees south of the main shaft, or, roughly speaking, about 320 feet east of the boundary fence between the leases and the freehold.

It is very evident that the bulk of the gold of Mount Morgan yet lies intact within the limits of the Freehold property.

The evidence now to hand, in my opinion, goes to confirm my original view that the auriferous material was deposited by a thermal spring. The deposit is freely intersected by felstone dykes, and lies on and is surrounded by the pyritous quartzite country-rock. Numerous dolerite and rhyolite dykes intersect the country-rock, but not one has been met with in the auriferous deposit. Had the auriferous deposit been merely the siliceous skeleton remaining after the removal of the pyrites from the pyritous quartzite, the dolerite dykes would still have remained to attest the original identity of the two masses. But there is at least one clear instance of a dolerite dyke intersecting the quartzite country-rock (in No. 1 Tunnel, 120 feet north of the shaft sunk from No. 5 Floor), and not intersecting the overlying sinter (in the south branch of the Freehold Tunnel, only 33 feet higher). This shows that the sinter and ironstone were *deposited on* and were *not altered portions of* the pyritous quartzite country-rock. It is hardly credible that the highly auriferous siliceous and ferruginous rocks now being worked represent merely a weathered condition of the pyrites, with which the quartzite "country-rock" is so highly charged and which is so poor in gold. Again, the fact that the sinter is mainly a hydrous silica is an argument against its being the skeleton produced by the solution of masses of pyrites from an *anhydrous* quartzite. A sample of the sinter from the Freehold Tunnel was submitted to Mr. A. W. Clarke, late Government Mineralogical Lecturer, who favoured me with the following interesting note :—

"A very large proportion of the substance is soluble in strong potash solution, the residue being nearly pure crystalline silica. This is what ought to be expected of a siliceous sinter, as, of course, the silica would be hydrated and colloidal, and the presence of some quartz in it (or crystalline silica) is quite conceivable."

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The occasionally angular condition of the sinter and tumbled condition of the ironstone masses (as evidenced by the deflection of stalactites from the vertical) would appear to indicate that explosive discharges of gases or steam occurred at intervals with sufficient violence to disturb the deposits accumulated by the thermal spring.

In view of the enormous quantities of pyrites associated with the quartzite country-rock, it may not be so necessary as it once seemed to ascribe the presence of gold on the summit of Mount Morgan to the solvent action of hot water charged with chlorine on a number of auriferous pyritous reefs, since even if gold existed in the pyrites in the country-rock in a very infinitesimal proportion, it might be collected by a thermal spring charged with chorine from the pyrites over a wide area.

Mr. J. Macdonald Cameron, M.P., F.G.S., &c., visited the mine in February, 1887, and reported to the directors on 26th March following, describing the mountain as "broadly speaking, consisting of a network of quartz veins about 200 feet in width, traversing on the one hand a metamorphosed matrix of somewhat argillo-arenaceous composition, largely impregnated, where it has been exposed to atmospheric influence, with oxides of iron, and on the other what appears to be a felspathic tufaceous igneous rock. The network of quartz veins is bounded on the eastern side by a narrow belt of ferruginous gritty sandstone, and divided near its western boundary by what a high authority has elsewhere termed an aluminous rock about 16 feet in width, striking north-west and south-east, from which there branches off in a fork-like manner to the north, at an angle of about 45 degrees, another band of soft white clay, consisting mainly of the silicates of alumina and magnesia, due in my opinion to the decomposition of a soft trachytic rock that doubtless contained bands of talc or steatite. On the western side of the so-called aluminous rock, and at what may be termed the boundary of the central auriferous zone, a rich gold-bearing network of quartz veins passes through similar sintery or tufaceous material to that which we find on the eastern side. Indeed the whole of this mount, except where we meet the so-called aluminous rock, the aluminic and magnesic silicate dyke on the west, the iron-bound clayey sandstone on the east, and the eruptive rocks in the cross-cut near the north end of No. 1 drive, may be considered as one mass of tufaceous material, from which some of the alkaline constituents of its felspar were washed out by aqueous percolations." Referring to my former report, Mr. Cameron asks, "If, as Mr. Jack remarks, the siliceous sinter could only be produced in the open air, how is it that about a quarter of a mile to the west of Mount Morgan proper it has been found in the bottom of what is known as the "Sugar-Loaf shaft," at a depth of about 250 feet from the summit of the mountain, immediately underlying a black lustrous quartz similar in appearance to that found in the central zone of the 'Mount'? Either the Sugar-Loaf Mount was itself a separate thermal spring, as it has been suggested Callan's Knob is, that vomited forth its auriferous contents fitfully for a time in the open air, and, becoming quiescent owing to a cessation of the forces that gave rise to it, was ultimately superimposed by a mass of rock of different composition to the so-called sintery mass found at the depths alluded to, or it is in age, character, and method of formation part and parcel of the iron-bound clayey sandstone which is found to the east and west of Mount Morgan proper. I must confess that my observations incline me to adopt the latter theory, though I shall certainly differ from Mr. Jack as to the nature of the method of formation."

I may say that recent exploratory work in Callan's Knob has tended to strenthen the belief that though it may be comparatively poor in gold it is of similar origin to Mount Morgan itself. I visited the upper and lower tunnels of the Sugar Loaf last month, and saw nothing in the upper tunnel which it seemed necessary to suppose was "superimposed" at a later date on the "so-called sintery mass" found in the lower tunnel.

"Then, again," continues Mr. Cameron, "the complete absence of calcareous tufa from the so-called siliceous sinter is somewhat against the thermal spring theory, for we know that from scarcely any of the eruptive rocks containing augite, hornblende and similarly composed minerals do we find lime absent, and if subjected to disintegrating solutions their lime would be taken up and deposited before, if not simultaneously with, the silica. Moreover, the kaolin dyke, which, as previously indicated, I believe to be the result of the decomposition of a trachytic rock that once traversed the very ground now being occupied by the kaolin, would have furnished lime to the hot geyser water had the latter emerged in contiguity to it, which, from the position of the so-called central pipe, it must have done if this theory be correct."

I freely admit that many of the "eruptive rocks containing augite, hornblende and similarly composed minerals" would furnish a limited quantity of lime to the solvents which may be supposed to have been present in a thermal spring, and it would be useless to deny that the deposit of Mount Morgan may contain traces of lime, but the lime would have to be furnished from a very wide area of eruptive dykes, &c., to form a calcareous tufa. I merely pointed out that as the sinter was siliceous and not calcareous large masses of calcareous rock, such as beds of limestone, were probably not among the rocks from which the spring was fed. The argument that the kaolin dyke "would have furnished lime to the hot geyser water had the latter emerged in contiguity to it" appears to be based on a misconception as to the age of the dyke in question. *The* "kaolin dyke," and other similar dykes, *intersect* the auriferous deposit, as may be seen from an examination of the sections of tunnels given herewith. In other words, they were erupted *after* the formation of the auriferous sinter, and could not have supplied the latter with any of its contents.

Mr. Cameron, in the same report, refers to a "fine volcanic dust" at the base of the Desert Sandstone described by me (but which he did not see) as "possibly, even probably, identical in age, character, and composition with what has elsewhere been termed the siliceous sinter of Mount Morgan, but what I verily believe to be none other than a trappean tufa or scoria." I quote the remark as further illustrating Mr. Cameron's view of the origin of the siliceous deposit of Mount Morgan, but I am certain that he would not have identified the "sinter" of Mount Morgan with the "fine volcanic dust" at the base of the Desert Sandstone if he had had an opportunity of inspecting the latter. Moreover, abundant evidence is given in my former report, and need not be repeated, that the Mount Morgan auriferous deposit is of later age than the Desert Sandstone.

As regards the age of the Mount Morgan geyser, some light has been thrown on it since the issue of my former report by the discovery of fossils in the Desert Sandstone at Croydon, proving that formation to be of Cretaceous (say, Upper Cretaceous) affinities, although resting unconformably on the "Rolling Downs Beds," which have also Cretaceous (say, Lower Cretaceous) affinities. The Mount Morgan auriferous deposit is newer than the Desert Sandstone.

In

In my former report I referred to the uncertainty regarding the age of the quartzites, greywacke and shales which form the "country-rock" of Mount Morgan. This uncertainty has since been di pelled by the assiduity of Mr. James Smith, of Rockhampton, who has found in the rocks in questic an abundant marine fauna, proving, according to Mr. Robert Etheridge, junr., Palæontologist to th Geological Survey of New South Wales and Australian Museum, their identity with the "Gympie Beds, which are on the horizon of the "Bowen River Beds" (Carbonifero-Permian). Pyritous rocks of thi age have furnished gold to the reefs at Gympie, and in the vicinity of Mount Morgan, and, considerin the immense quantity of pyrites in the quartzite immediately beneath and around Mount Morgan, migl well supply, under the stronger influence of a thermal spring charged with chlorine, even enough of gol to enrich the now famous Mount Morgan mine.

On my return to Rockhampton I made a traverse from South to North Rockhampton with a vie to forming an opinion on the question of whether it would be worth while to sink in the latter municipalit for artesian water. I found that the palæozoic strata dip in the Rockhampton Town Quarry at a hig angle to the north, while those on the edge of the Berserker Ranges to the north dip southward, also a a high angle. The intervening space, including the site of North Rockhampton, is occupied by a alluvial flat which covers the palæozoic rocks and is traversed from north-west to south-east by th Fitzroy River. There is every indication that a synclinal trough of palæozoic rocks underlies the alluvia flat. In the event of there being among the palæozoic rocks any bed sufficiently open to admit of th passage of water, an overflowing artesian well might be struck, having a pressure from "heads" in th Berserker and Athelstane Ranges; and in my opinion the experiment is worth making.

I also visited the brickwork at Byerley Siding on the railway line, one mile beyond Wycarba Station, and found that firebricks of a superior quality were being manufactured from a surface-wasl derived from a silicio-felspathic ashy sandstone containing frequent pisolitic concretions (along bedding planes) of silica in the form of agate, chalcedony, &c. The quantity of material is apparently inexhaustible.

APPENDIX.

I take the opportunity afforded by this publication to correct an error in a previous report. In my annua report for the year 1887 I said of the "Hidden Treasure" Mine, Palmer District, that 75 tons of stone had beer crushed at the Cradle Creek machine, but that the Warden's books contained no record of the crushings, unles they had been recorded under another name. I have since been informed by Mr. C. D. Keane, mining registrar Maytown, that the following crushings are noted in his books:—

"April, 1887,	crushed	30 tons for	199 oz.	12 dwts.	12 grs.	gold.
May ,,	,,	20 ,,	70 ,,	7 ,,	0 ,,	,,
March, 1878	,,	17 ,,	13 ,,	0 ,,	0 ,,	,,
Total	...	75 ,,	282 ,,	19 ,,	12 ,,	,,

Average yield per ton—3 oz. 15 dwts. 11 grs."

ROBERT L. JACK.

Geological Survey Office,
Townsville, 12th December, 1888.

Price 1s. 6d.]

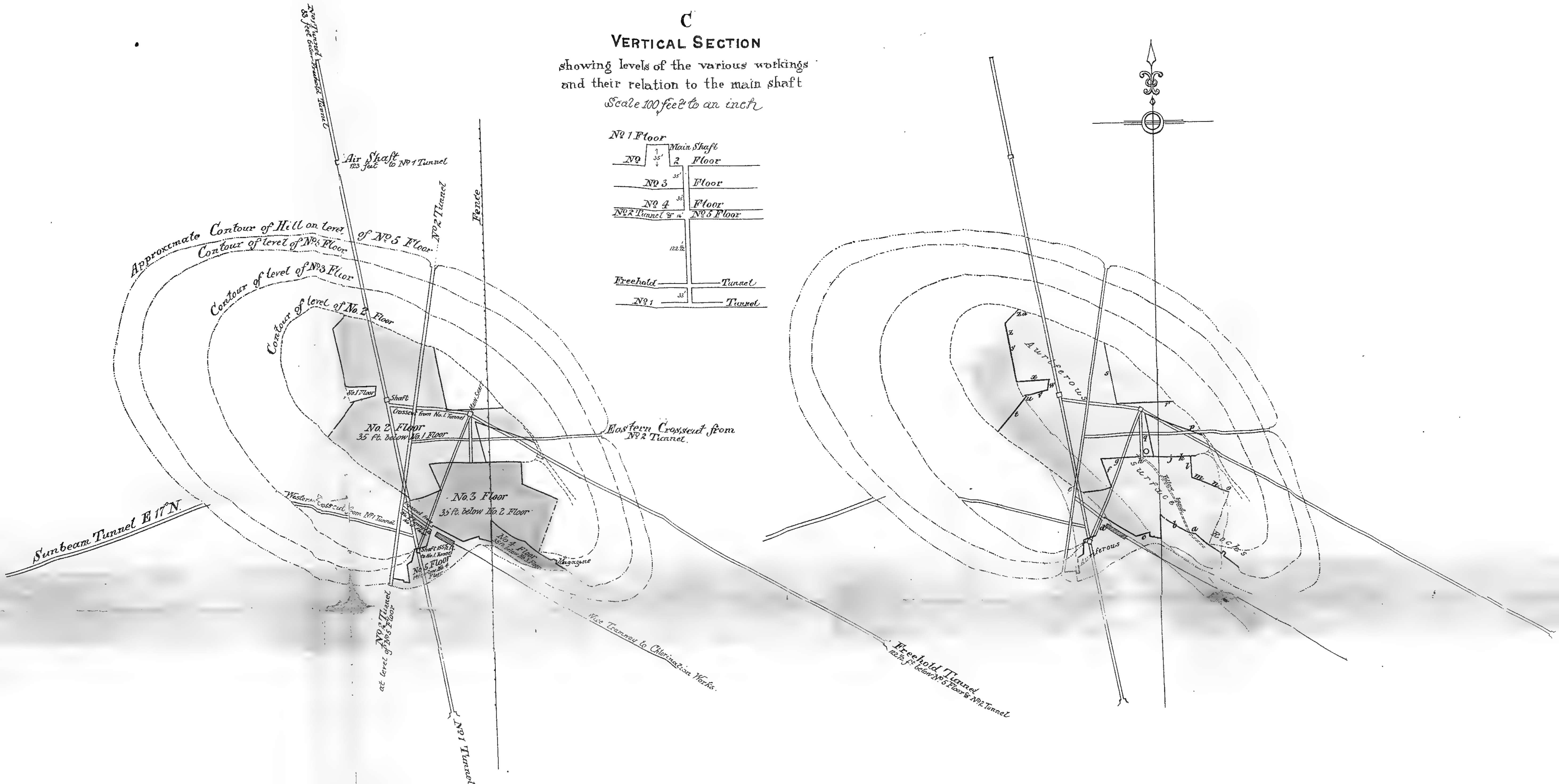
By Authority: JAMES C. BEAL, Government Printer, William street, Brisbane.

C

VERTICAL SECTION

showing levels of the various workings
and their relation to the main shaft

Scale 100 feet to an inch



A

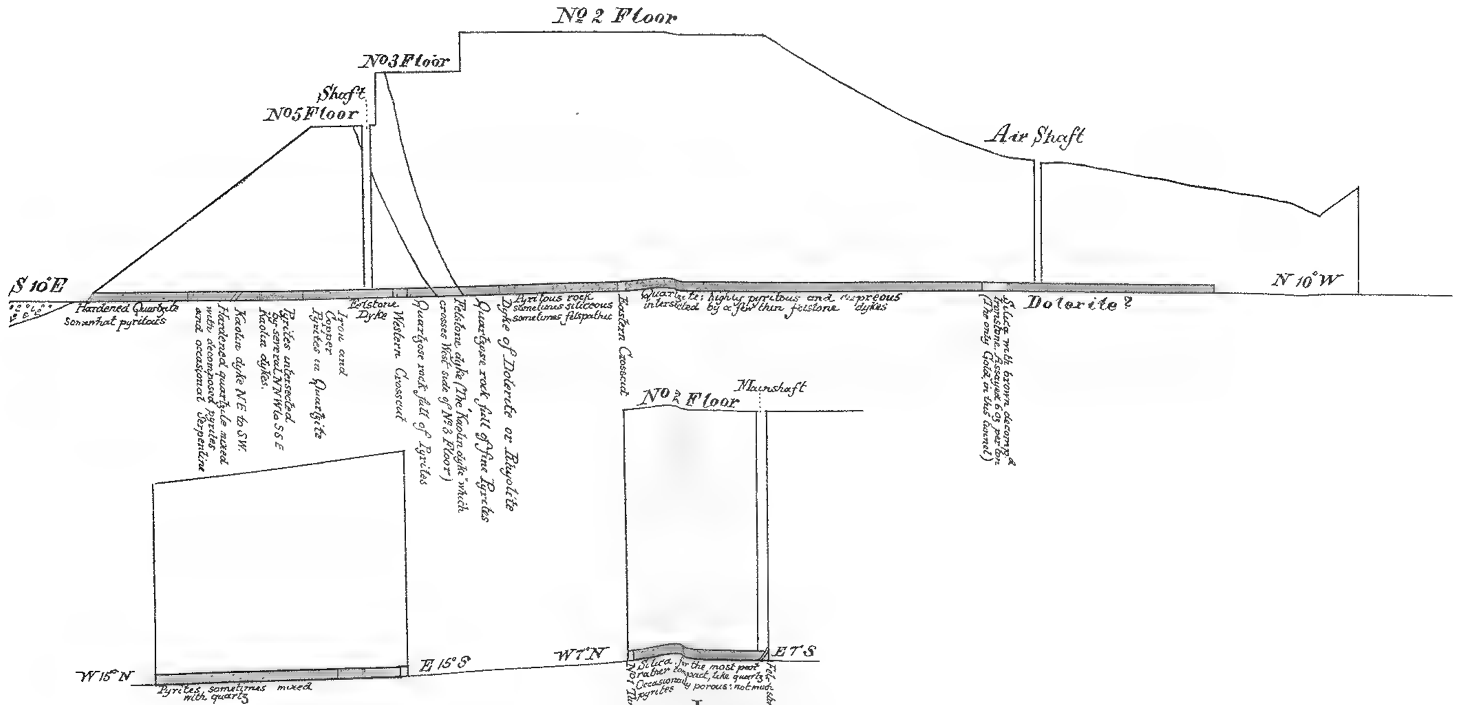
Sketch Plan of Mount Morgan
showing Surface Excavations, Tunnels and Shafts.

B

Plan with reference to descriptions in text.

H
Section of
No. 1 TUNNEL

Scale 100 feet to an inch

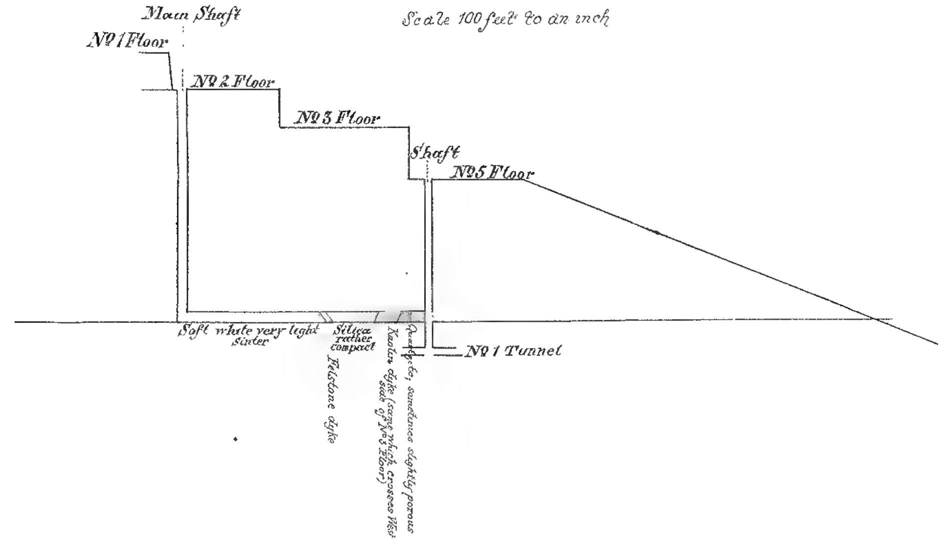


K
Section of
WEST CROSSCUT FROM
No. 1 TUNNEL

J
Section of
EAST CROSSCUT FROM
No. 1 TUNNEL

Section G

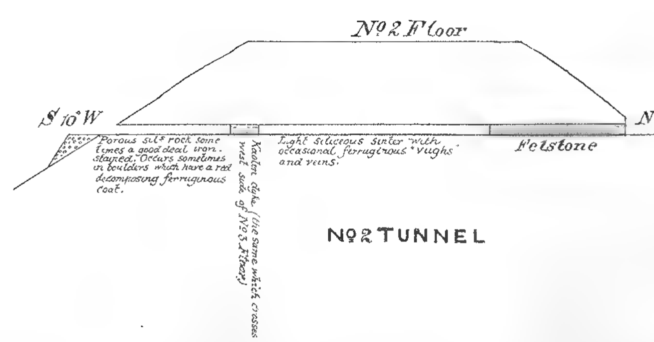
Scale 100 feet to an inch



SOUTHERN CROSSCUT FROM FREEHOLD TUNNEL.

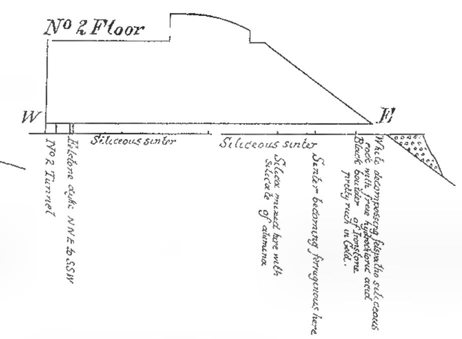
Section D

Scale 100 feet to an inch



No. 2 TUNNEL

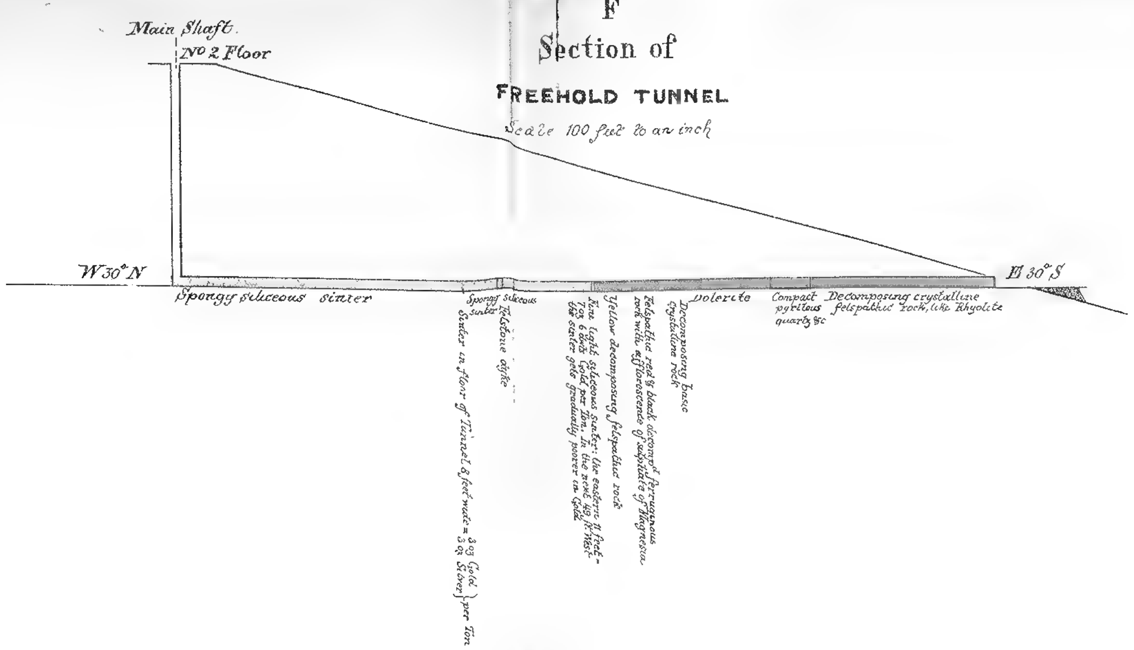
Section E

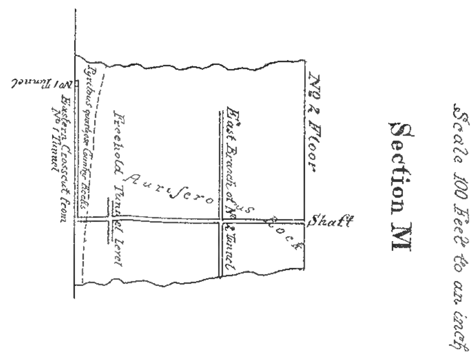


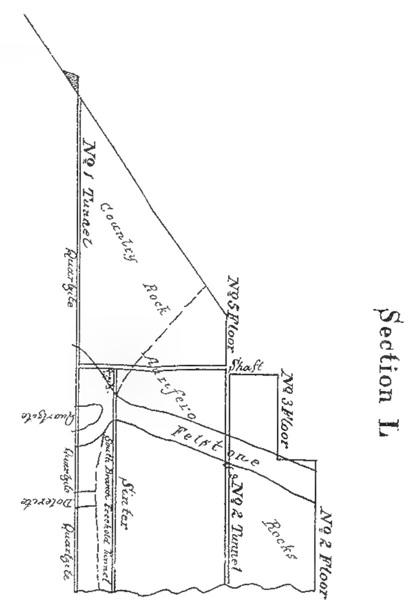
EAST BRANCH of No. 2 TUNNEL

F
Section of
FREEHOLD TUNNEL

Scale 100 feet to an inch







QUEENSLAND COMMISSION.

Centennial International Exhibition, Melbourne, 1888

THE MINERAL WEALTH OF QUEENSLAND.

BY

ROBERT L. JACK, F.G.S., F.R.G.S.,
GOVERNMENT GEOLOGIST

BRISBANE:
WARWICK AND SAPSFORD, PRINTERS, BOOKBINDERS, ETC., ADELAIDE STREET.

MDCCCLXXXVIII.

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MDCCCLXXXVIII.

INTRODUCTION.

THE following pages, written at the request of the Hon. the Minister for Mines and Works, are designed to give an idea of the present condition and value of the various mineral fields of Queensland, with an indication of localities where minerals still await the attention of miners and capitalists.

The Statistics are chiefly taken from the Annual Reports of the Department of Mines, and the rest of the information has been, as far as possible, derived from Official Reports. In the earlier years of Mining, however, Returns were not regularly made, and I have in some cases been compelled to resort to unofficial (though, I believe, reliable) sources.

This pamphlet is illustrative of the large "Index Map to the Mineral Wealth of Queensland," hung in the Queensland Court of the Centennial Exhibition, Melbourne. In the index at the end of the pamphlet the Mineral Fields are arranged in alphabetical order, and a list of latitudes and longitudes is appended to enable the reader to locate the places on the map.

The various fields described in the pamphlet are coloured on the map so as to show the areas where the mineral in question has actually been worked. The coloured areas bear no relation to the *legal* boundaries of the fields.

R. L. J.

GEOLOGICAL SURVEY OFFICE,
TOWNSVILLE, 1*st August*, 1888.

GOLDFIELDS.

Charters Towers and Cape Goldfields.

These goldfields, although both geographically and geologically distinct, are generally grouped together. They have for the greater part of their existence been in the charge of the same Warden, and the Returns from each have not always been kept separate. The **Cape**, although at one time a rich alluvial field, has of late years diminished in relative importance, so that at the present day its output does not seriously affect the total yield of the two fields.

In Daintree's "Report on the Cape River Diggings," &c. (Brisbane: By authority, 1868), it is said that payable gold deposits were "confined to the South Eastern outcrops of a vast thickness of schistose rocks developed on the 'Cape;' the North Western extension of the same having failed to yield the precious metal in remunerative quantities to the prospector." The metamorphic schists are divided by him into "Upper," "Middle," and "Lower." The "Upper" is composed of hard quartzites and silicified mica slates. The "Middle" consists of soft thin-bedded mica-slates, with occasional bands of silicified mica and hornblende schists. In the Lower Subdivision laminated granite, mica and hornblende slates are interstratified; and it is in this portion of the series that transmutation of the schistose rocks is most marked. Indeed, near the junction of the schistose and granite rocks, so great has been the alteration that it is difficult to say where the schists end and the granite commences.

"No fossils have yet been, or are likely to be, met with in these beds on account of their metamorphic character throughout. The only assertion to be made in regard to their age is, that rocks of a similar character further North are unconformably overlaid by others containing abundance of Upper Silurian fossils."*

In the map attached to the Report the metamorphic rocks are provisionally classed as "Lower Silurian." The Report further mentions that where elvan or porphyritic dykes traverse the metamorphic rocks, the richest gold deposits were always found. In some cases there was reason to suspect that "the rich quartz veins were a continuation to the surface of the elvan veins themselves."

Free gold is found in the alluvia of the present watercourses, generally in the vicinity of rich quartz reefs. But an older fragmentary drift, which Mr. Daintree calls Pliocene, yields gold of a rounded waterworn character, independent of any local source of supply. Several well-defined "leads" are mentioned, which, "Down the Cape so far as

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* Mr. Daintree probably referred to the Broken River, where rocks of a similar character are overlaid unconformably by a limestone charged with fossils. The fossils, however, turned out to be Devonian.

the Lower Diggings," and down Running Creek as far as the junction of Golden Gully, may be considered as the representative of old river channels; beyond these points, to the South and East, it can be regarded in no other light than that of accumulated sediment from a vast lake or sea. It has been found in working that where this supposed old watercourse is narrowest the gold is most concentrated; but when it becomes broader and the drift deeper, the gold is found to be too scattered to pay for the additional cost of mining. In 1867 the Warden estimated the population of the Cape at 900 Europeans and 100 Chinese, but gave no estimate of the gold produced. Before the Department of Mines began (in 1877) to publish Annual Reports, the population and production had greatly declined. In 1878 the population was estimated at 50 Europeans and 45 Chinese, and the production of gold at 3,000oz.; in 1879, the estimated yield was 2,400oz.; in 1880, 1,057oz.; in 1883, 1,000oz.; in 1884, 1,944oz.; in 1885, 877oz.; in 1886, 500oz.

The **Charters Towers Field** ranks third among Australian gold-producing areas, being only surpassed by Ballarat and Sandhurst. It will be seen, that the above Returns from the Cape are so small as scarcely to affect the totals credited to Charters Towers.

The richest part of the goldfield lies on the Western edge of a large area of granitic rock. The granite varies from a type in which orthoclase felspar, mica and quartz are the essential minerals, and hornblende an occasional or accidental mineral, to a type in which, in addition to the constant orthoclose and quartz, hornblende is the essential and mica the occasional mineral.

West of the granite several reefs are worked in less highly metamorphosed rocks, but not only are these reefs less rich in gold, but the gold is also more alloyed with silver. These rocks consist of quartzites, greywackes (of mixed quartz, felspar, and hornblende granules, with some mica), shales and slates. The slates and shales are highly impregnated with iron peroxide. The stratified rocks strike as a rule North West and South East, and dip at over 45 deg. to North East and South West. They afford no direct evidence of their age, but are covered unconformably by the Devonian limestone of Burdekin Downs.

About 16 miles south of Charters Towers gold occurs in thready hæmatite veins, which reticulate through a volcanic "Neck," named Mount Leyshon. This neck has been pierced partly through greywackes and slates, and partly through a porphyry. The porphyry is composed of straw-coloured silicated felspar, with crystals of orthoclase felspar and quartz, the latter occurring, however, most frequently in rounded blebs. It sends out veins through the greywackes and slates, and also through the granite which occurs to the North. The "Neck" is the once deep-seated pipe or core of a volcano, filled up with the fragmental material which supplied the ashy outbursts. This material varies considerably in texture, some portions being merely aggregations of fine felspathic dust, while others are agglomerates of

coarse angular *débris* of broken porphyry, cemented together by a sparse matrix of dust felted with iron oxide. Broken crystals and rounded blebs of quartz are scattered throughout the matrix; in fact, the material is exactly such as could be manufactured from the waste of the porphyry. Crystals of felspar in some cases appear to have been developed in the ash, so that but for the granular and clastic appearance of the matrix, the resemblance to the adjacent porphyry rocks would be complete. The rock will just about pay for passing through the stamps as a whole, picking the auriferous veins being an impossibility. Now and then larger masses of auriferous stone are met with. In the lower levels auriferous iron and copper pyrites begin to be met with, and it is possible that deposits concentrated in reefs will be discovered. The Neck is of considerable extent, covering nearly 200 acres, and is auriferous from its Northern end to its South Western extremity (Wallaby Point). It is singular that in the adjacent twin neck, Mount Mawe, the existence of payable gold has not yet been proved.

The reefs in the central portion of Charters Towers have no uniform trend, but take as a whole a sort of arrangement in the form of a horse-shoe, with the toe lying to the South West. The reefs forming the Western limb run from North North West to South South East, and those forming the Eastern limb from North North East to South South West. All underlie at low angles Eastward, Northward, or Westward towards the axial line of the horse-shoe. Some of the most important reefs, such as the Day Dawn and Queen, are cross reefs. Down to the water-level the gold was "free" in a gangue of granitic *débris* and quartz, mixed with "brown-stone" or decomposed pyrites. Below that level the gold occurs in quartz associated with a "Mundic" composed of pyrites, galena, and zinc-blende, which has not proved hard to treat.

The tables given by the Warden show that different mines come to the front year by year. At present the Day Dawn line is first favorite. In 1884, 1885, and 1886, the Day Dawn P.C. turned out 94,271oz.; the Day Dawn Block and Wyndham, 86,788oz.; and the Victory, 14,276oz. of gold; in 1885 the Eastward Ho gave 8,389oz.; in 1886 the Black Jack gave 8,834oz.; in 1885 and 1886 the North Queen yielded 16,089oz., and the Bonnie Dundee 7,919oz.

The total yield of Charters Towers and the Cape up to 31s March, 1888, is estimated at 1,637,870oz. How much of this came from the Cape it is now impossible to say. During late years the amount has been comparatively insignificant, but it is probable that for the six or seven years prior to the opening of Charters Towers (in 1872) it was of considerable importance.

From the following table of average crushings it will be seen that the yield from the stone at the deeper levels shows rather an increase than a decrease during the 11 years since the tables have been published. One mine has now reached a depth of over 1,400ft.

AVERAGE YIELD PER TON OF STONE CRUSHED.

		oz.	dwts.	grs.			oz.	dwts.	grs.
1877	...	1	16	22	1883	...	1	10	17
1878	...	1	10	1	1884	...	2	0	10
1879	...	1	10	13	1885	...	1	18	9
1880	...	1	14	22	1886	...	1	17	4
1881	..	1	10	12	1887	...	1	16	6
1882	...	1	14	19					

YIELD OF CHARTERS TOWERS AND CAPE GOLDFIELDS.

Year.	Alluvial Gold.	Reef Gold.		Total Gold.	Remarks.
	Ounces.	Tons of Quartz Crushed.	Oz. of Gold therefrom.	Ounces.	
To end of— 1875	...	...	...	442,976 [1]	[1] Deduced fr... figures in report... Department ... Mines for '72, p. 1...
1876	...	39,463	...	67,616	[2] "Tailings ... alluvial."
1877	21,929 [2]	36,030	66,479	88,408	[3] Does not inclu... gold from pyrit...
1878	18,849 [2]	35,510	53,340	72,189	[4] Not estimated...
1879	17,461 [2]	41,584	63,568 [3]	81,029	[5] Includes g... from pyrites.
1880	16,704 [2]	39,285	68,594 [3]	85,298	[6] Alluvial only...
1881	... [4]	45,378	82,324 [5]	82,324	[7] Includes g... from tailings...
1882	100 [6]	45,662	79,495 [7]	79,595	[8] "Tailings, ... luvial," &c., ...
1883	1,000 [6]	44,602	68,559	69,559	[9] "Tailings," ...
1884	3,099 [8]	52,568	106,236	109,335	
1885	1,000 [9]	70,164	134,650	135,650	
1886	... [4]	77,665	144,379	144,379	
1887	317 [6]	83,292	151,060	151,377	
Quarter ending 31 Mar., 1888.	... [4]	19,156	28,135	28,135	
Total	...	...	...	1,637,870	

Ravenswood Goldfield.

The country rock of this goldfield is a grey syenitic granite, ... which hornblende accompanies or takes the place of mica. Actinol... is sometimes substituted for the hornblende. The reefs belong to t... distinct systems, one running North and South and underlying to t... East, and the other running East and West and underlying to ... South. They generally have a quartoze gangue, and contain iron a... copper pyrites, arsenical pyrites, zinc blende, galena, &c., as well ... gold. This complex "Mundic," when exposed to alternate atm... pheric and aqueous influences, is decomposed, the metallic co... pounds being oxidised and the gold set free, and consequently t... field was a favourite "poor man's diggings" till the water level w... reached. At that level, however, the majority of the mines suffer... a severe check, as it was found to be impossible to save more than ... small proportion of the gold by amalgamation. The products ... some of the richer mines were for a time sent to Europe for tre...

ment, but many of the others which had paid well in the "brown-stone" did not produce a sufficient quantity of rich ore to yield a profit after paying expenses, of which the carriage to the coast formed the heaviest item. Roasting was also resorted to, and was successful in some cases. Smelting was next tried, but proved too costly. Chlorination Works are now in course of erection. If this process should prove equal to the extraction of the gold from what has hitherto proved an unusually refractory ore, Ravenswood will rank high among Australian goldfields.

A considerable quantity of alluvial gold has been obtained in Elphinstone Creek and other streams on the field, mainly by Chinese, who turn over the wash again and again. Alluvial and reef gold have, however, not been distinguished in the early Returns, and in more recent years part of the gold in the alluvia may have been derived from tailings.

YIELD OF RAVENSWOOD GOLDFIELD.

Year.	Reef Gold.		Alluvial, &c., Gold.	Total Gold.	Remarks.
To end of—	Tons of stone crushed.	Ounces of Gold.	Ounces.	Ounces.	
1875	...	...	...	170,649	Deduced from figures in Rept. Dep. Mines for 1884, p. 10.
1876	...	...	...	18,788	Includes gold from pyrites and tailings.
1877	10,441	11,963 [a]	...	11,963	[a] Includes gold from pyrites and tailings.
1878	15,500	13,252 [a]	...	13,252	
1879	15,700	15,744 [a]	...	15,744	
1880	13,479	12,620 [a]	825	13,445	[b] Includes gold from tailings.
1881	10,880	8,600 [b]	2,595 [c]	10,195	
1882	7,854	5,002	3,709 [d]	8,711	[c] Includes gold from exported mundic.
1883	7,985	6,054	6,946	13,000	
1884	13,202	11,828	2,364 [e]	14,192	
1885	11,039	15,916	1,725 [e]	17,641	[d] Includes alluvial gold and gold from tailings and exported mundic.
1886	4,706	7,406	1,839 [e]	9,245	
1887	6,589	6,842	3,548 [e]	10,390	[e] Classed as "alluvial" by Warden.
	Total ...	...	...	327,215	

Croydon Goldfield.

This Goldfield was only discovered in the end of 1884, and for some time its importance was not recognised. After some extraordinary crushings of Croydon stone at the Etheridge, the first

machine was opened on the field in November, 1886, and since then the prosperity of the place has advanced rapidly. The population was estimated at 8,000 in December, 1887.

The part of the field surrounding the township lies in granite country, with which quartzites and other metamorphic rocks are associated. In the Waterfall district the rock is a hard mass of finely laminated dust (probably volcanic) of silicated felspar, with roundish quartz blebs. Many of the reefs lie rather flat, and this circumstance gave rise at first to misgivings as to their permanency; but this prejudice, like many others, has had to yield to the logic of facts.

The Township of Croydon is on the very edge of the alluvial flat, which extends to the Gulf of Carpentaria. The auriferous rocks themselves nowhere rise to any considerable elevation. They are overlaid by isolated fragments of horizontal "Desert Sandstone." This wide-spread formation has hitherto yielded no organic remains of any value for palæontological purposes. On the Croydon, however, the Desert Sandstone is in places crowded with fossils, which Mr. R. Etheridge, of the Australian Museum, has determined to be of Upper Cretaceous types—many of the species being identical with those found in the "Maryborough Beds." Mr. Wallmann informs me that in collecting specimens for the Exhibition, he detected gold actually in some of the fossils. This is the more remarkable as the reefs do not intersect the Desert Sandstone.

The yield of gold from Croydon for 1887 was 31,787oz. from 10,950 tons of quartz. The total yield from November, 1886, to 30th April, 1888, is given by the local newspapers as 59,234oz.

Etheridge Goldfield.

The greater part of this extensive field is a coarse-grained granite with large crystals of orthoclase felspar and flakes of mica. Of this granite Mr. Daintree remarks* that it is simply transmuted mica schist, as shown by the presence of occasional bands of unaltered schist throughout the mass. The principal drawbacks to the field hitherto have been its inaccessibility and the isolated position of the reefs. Mines, without an output sufficiently large to keep their own crushing machinery going, have again and again been abandoned owing to the cost of carriage to the nearest mill. The principal centres of mining are the Cumberland, Durham, Georgetown, Finnegan's, and Goldsmith's. The introduction of English capital attracted by the display at the Colonial and Indian Exhibition of 1886 has begun to tell favourably on the output of the field. The Cumberland, one of the most productive mines in the Colony, has an elvan

* "General Report upon the Northern District." Brisbane: By authority, 1870.

dyke between the walls, the reef sometimes occupying its upper and sometimes its lower side. The quartz reefs, except above the water-level, are generally charged with iron pyrites, copper pyrites, arsenical pyrites, zinc blende and galena, in varying quantities. The mines at Goldsmith's form, geologically, part of the Gilbert Goldfield, being situated in mica-schist country. The stone is less difficult to treat than that in the granite.

The Etheridge and Gilbert having been, during the greater part of their history, in charge of the same Warden, the returns from these fields have been generally lumped together. This is unfortunate for statistical purposes, as the two fields are geologically distinct. In the following table the greater part of the reef gold must have come from the Etheridge, and the greater part of the alluvial gold from the Gilbert. In 1881 and 1882 the return also includes gold from the Woolgar. The amount from the Woolgar in 1881 must have been trifling as the Warden at the end of the year reported that the crushing machinery was only "nearly ready." In 1882 the amount from the Woolgar was probably about 2,000oz.

YIELD OF ETHERIDGE GOLDFIELD.

Year.	Stone Crushed.	Yield Therefrom.	Alluvial Gold.	Total.
	Tons.	Ounces.	Ounces.	Ounces.
To end of—1875	—	—	—	*129,798
1876	—	—	—	13,202
1877	3,134	4,837	—	4,837
1878	3,550	6,365	1,031	7,396
1879	4,417	5,927	9,571 ?	15,498
1880	4,455	8,821	11,547	20,368
1881	12,151	20,926	2,104	23,030
1882	7,428	13,190	5,241	18,431
1883	10,751	16,127	2,840	18,967
1884	7,010	16,560	1,000	17,560
1885	11,354	22,708	—	22,708
1886	10,983	22,700	500	23,200
1887	8,100	24,603	50	24,653
				339,648

*Deduced from figures in Report of the Department of Mines for 1884, p. 11.

Gilbert and Woolgar Goldfields.

These fields, although conterminous with the Etheridge, differ from it essentially in their geological characteristics. The divide between Caledonia Creek (one of the heads of the Delaney River, a tributary of the Etheridge) and the Robertson River (a tributary of

the Gilbert) is dotted over with little fragmentary tablelands of Desert Sandstone. The latter formation, as mapped by the late Mr. Richard Daintree, occupies considerable areas in the Newcastle and Gregory Ranges, and between Agate Creek and the Percy Rivers. The conglomerate beds of the formation are rich in Agates, topazes, garnets, and other precious stones, including, it is said, rubies, sapphires, and diamonds.* Another belt of the Desert Sandstone makes its appearance on the heads of the Woolgar, where it is capped by basaltic rocks, probably of Tertiary age. Beneath the Desert Sandstone lie the metamorphic auriferous rocks of the Gilbert and Etheridge Goldfields.

According to a Geological Map of the Gilbert, published by Daintree in 1869, the country near the junction of the Robertson with the Gilbert is composed of "slates, shales, &c.," of Lower Silurian Age skirting West North West. Regarding the age of the rocks in question, I am not aware that there is any direct evidence beyond their general lithological resemblance to Victorian Lower Silurian Rocks. The Upper Waters of the Robertson and heads of the Gilbert are mapped as "Metamorphic-Mica Schists" striking West South West. These and the "slates, shales, &c.," are penetrated by numerous dykes of "elvanite, diorite, hornblende rocks, &c.," and it is noted that "where these elvanites penetrate slates, payable gold is usually obtained."

The geological characteristics of the Woolgar Goldfield are similar to those of the Gilbert.

The Output of the Gilbert is impossible to estimate, as the returns have been hopelessly mixed up with those of the Etheridge. In 1877 the Warden reported that in the years 1869–1872 the field "gave employment to a large number of European and Chinese miners, but from a variety of reasons it has been entirely abandoned for upwards of three years, but it is again showing signs of renewed activity." During the past year the crushing machine at Mount Hogan has been put into working order, and 779 tons of quartz, the produce of the reefs in the vicinity of Mount Hogan and the "Twenty Mile," crushed for a yield of 994oz. 16dwts of gold. In 1878 there was a considerable accession to the population engaged in alluvial working, and preparations were being made to re-open abandoned reefs. In 1879 the earnings of 500 Chinese were estimated at a minimum of 7,000oz of gold. In the same year the Gilberton Gold Mining Co. crushed 420 tons of stone for a yield of 142oz. 15dwts. In 1880 the alluvial diggings were estimated to have yielded 6,260oz. In the Warden's Reports after 1880 no separate estimate is made. In 1885 the Warden reported that the Mount Hogan and "Twenty Mile" Reefs had crushed during the year 162 tons for 365oz. of gold.

* Mr. Warden Samwell, in Report of the Department of Mines for 1873.

In the case of the Woolgar, the returns up to 1882 are to some extent mixed up with those of the Etheridge, but so far as they can be separated, the following are taken from the Warden's Books :—

YIELD OF WOOLGAR GOLDFIELD.

Year.	Tons of Stone Crushed.	Yield of Gold.	Alluvial Gold.	Total Gold.
		Ounces.	Ounces.	Ounces.
1880	—	—	2,500	2,500
1881	—	—	500	500
1882	(Returns included in Etheridge.)			—
1883	1,200	2,400	200	2,600
1884	1,734	1,976	350	2,326
1885	5,006	3,940	—	3,940
1886	2,819	2,079	350	2,429
1887	694	709	—	709
	11,453	11,104	3,900	15,004

"Galena carrying silver is found in abundance on the [Gilbert] field. Near Gilberton three parties of men are opening galena lodes, from which some good assays of silver have been obtained. At the Percy River, rich bismuth ore is found in gullies formerly worked for alluvial gold. Three men worked this ground for some time, and stacked a large quantity of washdirt containing ore. They also discovered a reef carrying the ore in small quantities. The absence of a market for the ore in the colonies, and the uncertainty as to the price obtainable in England, have had the effect of discouraging the Miners, and work has now been discontinued."* The ore referred to is the Carbonate of Bismuth, and what samples I have seen of it are almost chemically pure. "The principal lodes are found towards Gilberton, viz., Galena, large, carrying a good percentage of gold and silver, and pure galena; bismuth, and bismuth and copper; copper; silver, with lead and sulphur; silver; silver and antimony; and so on. They are of various colours, and some of the lodes are of great width, and traced for miles along the surface of the ground. Tin is also met with, tin and copper having been worked on the east of the Einasleigh River."† "Silver in galena lodes, with a percentage of gold, and indications of copper, exists on the Woolgar."‡

* Warden's Report in Reports of the Department of Mines for 1881.

† Mr. Warden Samwell's Report in Reports of the Department of Mines for 1883.

‡ Mr. Warden Samwell's Report in Reports of the Department of Mines for 1886.

Palmer Goldfield.

The Palmer Goldfield, so far as it has been hitherto opened up, occupies an area which may be roughly estimated at 2,300 square miles. This estimate, as in all other cases, has no relation to the area of the "Proclaimed Goldfield." The greater part of the Goldfield is occupied by shales and sandstones in strata, which are tilted up so as to strike from North and South to North North West and South South East, nearly vertical but dipping slightly to West and West South West. Associated with the sandstones, shales, and obviously part of the same series, is a belt of limestone, traceable from four miles North of Palmerville Southward to the Mitchell River. These stratified rocks have not suffered any appreciable degree of metamorphism; but, owing to lateral pressure the shales have occasionally been cleaved so as to become true "slates." They are traversed by dykes of igneous rocks (dolerite and diorite) of much later date. Regarding the age of the stratified rocks no direct evidence has yet been discovered, the shales and sandstones having yielded only undistinguishable plant-remains, and the limestones only traces of encrinites and corals of indeterminable genera. From the lithological resemblance of some of the beds, however, to others found in the Hodgkinson Goldfield, it may be inferred that the Palmer rocks are identical with those of the Hodgkinson, whose age will afterwards be discussed.

Ninety-four per cent. of the gold hitherto obtained from the Palmer has been alluvial gold. The reefs in the neighbourhood of Maytown generally strike West North West and North North West, and underlie toward the South and West. Those at Limestone may be arranged in three groups—the first, running North and South and underlying to the West; the second, East and West, and underlying to the North; the third, North East and South West, some underlying North West and some South East. These reefs, although only recently opened, promise to be among the richest in the colony. The Normanby group of reefs follows no definite rule in the bearing and underlie.

As will be seen from the following table, the reefs have yielded, from 1874 to 1887 inclusive, 75,393oz. of gold. The yield from this source reached its maximum in 1876, the third year of working. This was owing, in the first place, to the ease with which gold could be extracted from the surface stone, and in the second place to the comparatively large number of European Miners then on the field, who had been originally attracted by the alluvial diggings. The reefs, however, at present show signs of increased activity and productiveness.

The production of Alluvial Gold reached its maximum in 1875, the third year of the existence of the field. The bulk of the total output of 1,196,779oz. of alluvial gold from 1873 to 1877 has, unfortunately, been reaped by Chinese.

North of the Palmer River, the auriferous rocks are covered by a horizontal cake of the Desert Sandstone (Upper Cretaceous). This Desert Sandstone, there are cogent geological reasons for believing, may cover extensive deep leads of concentrated auriferous wash, which may yet prove even richer than the old alluvial diggings of the Palmer. It may be mentioned that the alluvial gold in many cases is found in localities where it is impossible to believe that it can have come from local reefs; and everything points to the old land surface now covered by the Desert Sandstone as its original source.

YIELD OF PALMER GOLDFIELD.

Year.	Alluvial Gold.	Reef Gold.		Total.
	Oz.	Tons quartz.	Oz.	Oz.
*1873	58,829	...	...	58,829
1874	150,000	...	200	150,200
1875	250,000	...	400	250,400
1876	185,000	4,766	15,000	200,000
1877	167,760	4,949	11,811	179,571
1878	112,000	4,061	8,233	120,233
1879	79,998	4,814	10,002	90,000
1880	58,513	3,016	6,920	65,433
1881	45,171	3,170	6,789	51,960
1882	33,092	2,704	4,247	37,339
1883	21,171	2,702	2,918	24,089
1884	13,764	1,902	1,873	15,637
1885	9,960	1,676	2,953	12,913
1886	6,521	1,101	2,066	8,587
1887	5,000	1,477	1,981	6,981
Grand totals	1,196,779	...	75,393	1,272,172

* Deduced from data on p. 10 of Department of Mines Report for 1884.

Coen Goldfield.

As an alluvial field, the Coen had a short existence (from February to July, 1876). The country rock is granite, greywacke, mica schist and quartzite. The alluvial gold was poor in quality and insufficient in quantity. Several reefs occur in the neighbourhood of the diggings. One of these, the Llankelly, is now being worked profitably.

Hodgkinson Goldfield.

This goldfield extends from the divide between the head of the Hodgkinson River and Leadingham Creek (an affluent of the Walsh River) North Westward for about 40 miles down the valley of the Hodgkinson.

There is a well-marked connection between the geological structure of the field and its physical features. The stratified rocks

consist of clay shales, greywackes composed of grains of a basic felspar, and a hornblendic rock, with minute flakes of mica and grains of quartz, quartzose grits and conglomerates. The strata have a general North West and South East strike, and dip, usually, at a high angle to the North East. In the central portion of the field the total thickness of strata exposed has been calculated at 21,000 feet, although neither top nor bottom has been recognised.

The nearly parallel valleys of Caledonia Creek (Glen Mowbray) and the Hodgkinson River are bounded on the North Eastern side by the Mount McGann Range, and on the opposite side by the Mount Robert Range. These ranges have had their trend determined indirectly by the forces which compressed the strata of the district from South West to North East, and threw them into long folds from South East to North West. After the strata had been compressed into nearly as small a space as they could be made to occupy, *i.e.*, until they became nearly vertical, the further operation of the same pressure resulted in the formation of fissures along lines of weakness, which lines of weakness were found in the bedding-planes between the upturned strata. These fissures, which are nearly parallel with the outcrops of the strata, have been filled with a rock of great hardness, which, by its power of resisting denudation, has given rise to the Mount McGann and Mount Robert Ranges. Both of these ranges occur in zones in which the hard rocks in question are closely grouped together, while the intervening softer "country" has been channelled into deep valleys by the Hodgkinson River and Caledonia Creek. The material with which the fissures are filled forms veins or dykes, from 3 to 40 feet in width, of pure silica, in almost all of its various forms. It frequently resembles quartzite, and occasionally passes into ribbon jasper and chalcedony. The veins are often so laminated parallel to their sides as to suggest that they may be beds rather than veins, but the mode in which they now and then cut across the adjacent strata, although preserving a general parallelism, disproves this theory. Crystallization of the silica is comparatively rare, and the lamination seems to imply not so much segregation of the silica from the adjacent strata as deposition of silica during the passage of copious sheets of hot water charged with the mineral in solution. The veins are very remarkable features in the landscape and can be followed from hilltop to hilltop forming, at times, rough insurmountable walls a hundred feet high. In other places, denudation has left their remains on hillsides or hilltops in the form of large cubes of silica from which the surrounding softer rocks have crumbled away. These cubes stand up weird and solitary like the "perched blocks" of alpine and arctic lands. The veins extend for very long distances. One of them has been traced for six miles and is undoubtedly much longer. Some, I have been informed, contain a little gold. Specular iron ore, brown hæmatite, and binoxide of manganese are not uncommonly found in cavities in the larger veins.

The evidence bearing on the age of the stratified rocks of the Hodgkinson is still incomplete. Remains of a *Lepidodendron*, probably *L. Australe*, McCoy, have been found in the "Chance" tunnel. Some indeterminable corals and a brachiopod, like *Rhynchonella*, have been collected from a limestone near Beaconsfield. Of more doubtful value are some reed-like plant remains from shingly pebbles of black shale, and corals from limestone pebbles, in conglomerates in Glen Mowbray. Had the plant remains and corals from the conglomerate pebbles been recognisable, and of value for palæontological purposes, there would still remain doubts as to whether the pebbles were derived from an older formation. The shale pebbles so strongly resemble some beds of shales occurring both above and below the conglomerate in which they occur, and the limestone pebbles so strongly resemble the limestone of Beaconsfield, that I believe both have been derived from contemporary and not from pre-existing deposits. *Lepidodendron* is a characteristic fossil in the "Star Beds" (Lower Carboniferous), but has never been traced upward into the productive portion of the Coal Measures (Carbonifero-Permian or "Bowen River Beds"). It seems most convenient for the present to regard the Hodgkinson Beds as part of the missing strata represented by the unconformability between the Burdekin Beds (Devonian), and the overlying "Star Beds."

The auriferous reefs are divisible into two natural groups. Those of the first group coincide with the strike of the stratified rocks, and underlie at right angles to the dip of the strata. This circumstance points to the continuance of the pressure which tilted up the strata to the point when it had to find relief in fissures and "thrust-planes." The reefs of the second group run mainly at right angles to the out-crops of the stratified rocks. They probably are newer than the first group.

YIELD OF HODGKINSON GOLDFIELD.

Year. To end of—	Alluvial. Oz. gold.	Stone crushed. Tons.	Yield. Oz. gold.	Total. Oz. gold.
1876	24,986	...	712*	25,698†
1877	4,000	13,218	29,818	33,818
1878	4,000	25,949	40,435	44,435
1879	2,021	21,422	31,654	33,675
1880	not estimated.	19,472	25,096	25,096
1881	2,941	10,649	12,367	15,308
1882	928	9,969	11,567	12,495
1883	not estimated.	8,032	7,203	7,203
1884	not estimated.	7,750	6,943	6,943
1885	not estimated.	5,362	5,553	5,553
1886	not estimated.	5,333	4,288	4,288
1887	not estimated.	2,686	2,399	2,399
Totals	... ..	129,992	178,035	216,911

* Deduced from figures on p. 11 of Report of the Department of Mines for 1884.
† Deduced from figures in Report on the Hodgkinson Goldfield. By Robert L. Jack, 1884.

The total amount of gold won from the Hodgkinson from 1876 to 1887 inclusive, as will be seen from the foregoing table, has been 216,911oz. The alluvial gold has not always been estimated by the Wardens, but it probably amounted to about 50,000oz. for the above period.

Mulgrave Goldfield.

The Mulgrave River has evidently at one time entered the sea in Trinity Bay, but has been deflected—probably by the flows of basalt which fill up its valley down to the point where it turns sharply round to the South to flow into the sea at Port Constantine. It is a magnificent river, and drains the North side of Mount Bartle Frere, the eastern edge of the Barron Tableland, both sides of the Bellenden-Ker Ranges, and the Western slopes of the Malbon-Thompson Range. The "Lower Camp," or Goldsborough, is on the left bank of the river, at its junction with Toohey Creek. The Upper Camp is about six miles South of Goldsborough, on the spur dividing Toohey Creek and the Mulgrave. The walls of the Mulgrave Valley are mainly of greywacke, slate and quartzite; but between the Lower and Upper Camps flows of Basalt fill up the lower portions of the Mulgrave and Toohey Creek Valleys. In following the track from the Upper Camp to Herberton the stratified rocks continue to the edge of the Basaltic tableland of the Barron. The "Fisheries" track from the Mulgrave to Herberton, on the other hand, makes its ascent to the edge of the Basalt tableland over granitic rocks. These are evidently two distinct periods of basaltic outflows; the first, that which "levelled up" the Barron Tableland, and the second, that which choked up, at least for a time, the Mulgrave and other valleys which had been carved out of the tableland.

A good deal of gold has been got in the alluvia of the Mulgrave at and below Goldsborough, but no accurate statistics are now obtainable. No serious attempt has as yet been made to search for gold *beneath* the newer basalt. The same may be said in this locality of the older basalt of the tableland, although the latter is continuous with the basaltic flows of the Upper Russell, beneath which payable drifts have been recently discovered.

At the Lower Camp are the Alice Reef, underlying to South South East at 70 degrees (coincident with the bedding of the slates and greywackes), the Cairns Co-operative Co.'s Reef, vertical and running West South West. At the Upper Camp are the Homeward Bound, Orient, Mowbray, Mabel, Scandinavian, and others. The reefs resemble in many points those of the Hodgkinson, and, although they cover only a limited area, some of them are likely to prove rich.

The following information regarding the yield of the Mulgrave is all that can be extracted from the Wardens' Reports, which are evidently imperfect, especially as regards alluvial gold obtained in the early days of the field.

YIELD OF MULGRAVE GOLDFIELD.

Year.	Quartz Crushed.	Yield of Gold Therefrom.	Total Gold.
	Tons.	Ounces.	Ounces.
1879	No crushings.		440
1880			1,122
1881			784
1882	442	446	502
1883	174	302	302
1884	29	230	302
1885	222	260	275
1886	100	262	262
			Total: 3,989

Russell River Goldfield.

This is a recently opened alluvial field which is likely to rise into pre-eminent importance. Its centre is about six miles west of Mount Bartle Frere. The gold is found associated with fine-grained stream tin ore in a gravelly wash beneath basaltic flows, about 2,500 feet above the sea level. This basalt forms part of the tableland which extends from the heads of the Russell, Johnstone, and Mulgrave to the basin of the Barron, near Herberton, and is covered with dense tropical jungle and intersected by plentiful running streams. It probably dates, like the Victorian basalts overlying auriferous drifts, from Miocene times, but of this no direct evidence has yet been observed. Wairambar Creek, on the West, and Cooppooroo Creek, on the East, have cut through the basalt, exposing the underlying auriferous drift and the "bedrock" of slates, schists and greywackes. Extensive preparations for sluicing the drifts have recently been made, and as the area covered by the basalt is enormous, and the drift has been exposed owing to the accident of denudation merely on the fringe of the deposit, almost unlimited possibilities are before the field. The average yield from washdirt reported in Victoria for 1883 was 1 dwt. 23.32 grains; for 1884, 3 dwts., and for 1885, 1 dwt. 10.59 grains. I am certain that the terraces of the Russell will give a much higher yield than this, and there is no comparison between the extent of the auriferous areas of Victoria and those of the Russell.

Gold and stream tin ore are found in the beds and alluvial flats of the lower Russell and the Johnstone. No reefs of any importance have yet been found in the district, and it is probable that the gold has been mainly derived from the denudation of the drifts beneath the basalt.

Cloncurry Gold and Copper Fields.

The greater part of this extensive area is covered by highly-inclined slates, quartzites, and greywackes, with occasionally a bed of limestone. These have so far proved unfossiliferous, and there is no distinct evidence of their age. These rocks form, as it were, a peninsula extending South-Eastward from the North West corner of the colony, and projecting into the Cretaceous Rocks of the "Rolling Downs" formation. In the neighbourhood of the Mount Douglas gold mines, the country is studded with rugged knobs of granular quartzite, which may represent the discharge pipes of geysers. The field is intersected with enormous siliceous veins like those of the Hodgkinson Goldfield. A few small isolated tablelands of the Desert Sandstone attest the former extension of that formation.

The Gold mines have been worked in a desultory and unsatisfactory manner, for which the position of the field is no doubt in large measure to blame. The Gilded Rose, on Fisher's Creek, in a country-rock of flaggy talcose sandstones and shales, has been most persistently worked. The reef is highly charged with pyrites. The Carbonates of Copper in the Homeward Bound and Flying Dutchman Lodes contain a good deal of gold. In the Uncle Tom, on Pumpkin Gully, the gold is associated with quartz, carbonate of lime, and carbonate of iron. In the Mary Douglas, at the "Top Camp," rich deposits of gold, associated with native bismuth, have been obtained from quartz coated with botryoidal and stalagmitic masses of glossy-black limonite. The gullies and flats radiating from the Mary Douglas Hill have yielded rich alluvial gold, all heavy and nuggetty, and frequently so coated with iron oxides that the miners knew it as "black gold." One nugget weighed 28lb. Alluvial gold, with native bismuth, is extensively distributed in the Pumpkin Gully region, and would pay well to work by hydraulic power, if it could be brought to bear.

The total amount of alluvial gold reported since 1877 is 3,023oz. but it is obvious that the returns are very incomplete. The total amount of reef gold from 1877 to 1886 is 4,392oz., but, as the amount of stone crushed is not in all cases given, the yield per ton cannot now be estimated.

The Cloncurry field contains some very extensive deposits of copper ore. The chief of these are the Great Australian and the Argylla. The copper is in the form of Carbonates and red oxides. The latter ore, of which there are enormous deposits, is frequently richer than chemically pure red oxide, being mixed up with native copper. The Great Australian is the only Mine which has yet been worked to any extent, and has produced, in 1885-7, 3,250 tons of ore, valued at £33,520. This return is singularly small, but the low price of copper for some time past, when taken in connection with the expense of land carriage, sufficiently accounts for the restriction of the output, pending the construction of a railway to the coast.

Argentiferous lead lodes occur on the field, chiefly in the Dugald Valley. One of these, still unworked, is over a mile in length.

The most striking features of the country are mountains of pure specular and magnetic iron ore. One of these—Mount Leviathan—is about 200ft. high, and a quarter of a mile in diameter at its base. It is singular to reflect that these deposits, which, if they were located in England, would be colossal fortunes for their owners, are at present absolutely valueless owing to their geographical position.

YIELD OF CLONCURRY GOLDFIELD.

Year.	Stone Crushed.	Yield therefrom.	Alluvial Gold.	Total.
	Tons.	Ounces Gold.	Ounces.	Ounces.
1877	1,190	1,205	alluvial ? 295	1,500
1878	1,014	1,316	...	1,316
1879	209	293	...	293
1880	406	490	...	490
1881	...	no returns.	...	...
1882	410	453	...	453
1883	no returns.	say 500	say 500	1,000
1884	no returns.	no returns.	...	...
1885	no returns.	50	alluvial ? 400	450
1886	80	85	566	651
1887	...	...	1,262	1,262
Totals	...	4,392	3,023	7,415

YIELD OF CLONCURRY COPPER FIELD.

1885,	1,340 tons raised,	value,	£18,920.
1886,	900 ,,	,,	7,000.
1887,	1,010 ,,	,,	7,600.
Totals,	3,250 tons.		£33,520.

McKinlay Goldfield.

This field is believed by many to be a promising one, but has not as yet been steadily worked. Several reefs have given good returns for a time, and a considerable quantity of alluvial gold has been won, but no record appears to have been kept. The country-rock is said by Daintree to be of metamorphic rocks (gneiss and mica and talc schists). "The associated minerals are gold and copper, the presence of 'dykes' of intrusive material seeming to be the chief cause of mineralisation." (General Report upon the Northern District. Brisbane: By authority, 1870.)

Normanby and Marengo Goldfields.

Normanby.

There are no less than three Goldfields in the Colony known as Normanby. The one here referred to lies about 40 miles South of Bowen, on the heads of the Dart and Grant, tributaries of the Broken River.

The goldfield occupies a portion of the Clarke Range. That range consists almost entirely of metamorphic rocks. That these have undergone metamorphism, followed by extensive denudation, prior to Carboniferous times, is proved by the relations they bear to the Bowen River Coalfield. There is much probability, but no direct evidence, in favour of a pre-Devonian metamorphism. In some places shales, slates, quartzites, greywackes, lydian-stone, and mica and hornblende-schists are met with; and there is little doubt that the whole table-land was originally composed of stratified rocks. In the immediate neighbourhood of Normanby, however, the occurrence of stratified rocks is notably rare, and the country-rock mostly consists of a species of porphyry, composed of quartz, black mica (sparsely), and crystals of schorl. The whole rock is mixed up with minute crystals and streaks of pyrites, and streaks and veins of serpentine. Occasional sections show a passage from greywacke to the rock just described.

In 1872-3 the Hibernia, Grace Darling, Marquis, Welcome, Star of Hope, Albion, New Zealand, Venture, and other reefs were at work, and everything went well till the water level was reached, crushings of from 1oz. to 2½oz. being the usual return. At the water-level, however, "Mundic" took the place of the easily-reduced "brown-stone," and as at the time the treatment of Complex auriferous ores was little understood the claims one after another were abandoned, although the stone assayed sometimes as much as 8½oz. to the ton. The field is suffering from an unjustly acquired bad reputation; had it been discovered 15 years later, it would probably have entered at once on a course of unchecked prosperity.

Now that miners have seen what can be done with mundic stone in other places, a number of the old hands have resumed work, believing (with good reason) in the future of the field. Several new reefs have also been opened up, and some show at the surface very good prospects. The assistance of capital, however, is absolutely necessary at the present juncture, the old machines having been removed to other fields. Probably the mundic stone will have to be treated by chlorination.

From 1877 to 1883 the Annual Reports of the Department of Mines give the following statistics of gold from "Normanby, Marengo,

and Mount Wyatt," the greater part must have come from Normanby, and was probably chiefly alluvial gold :—

	oz.
1877	220
1878	635
1879	712
1880	406
1881	273
1882	308
1883	201
Total	2,755

Marengo.

This small field lies about 23 miles South West of Bowen, on a low tableland dividing the head waters of the Bogie from the parallel valley of the Don. The lithological description of this limited area may be applied to the whole of the range between the Burdekin and the Coast—essentially a white granite, in which the mica is sometimes supplemented and occasionally replaced by hornblende, frequent bosses of intrusive pale pinkish felspar-porphyry (the felspar highly acidic), and occasional small areas of gneiss and mica-schist and of unmetamorphosed, or at least still recognisable, shales and greywackes.

About a dozen reefs were worked for a short time from 1871, but proved too poor for profitable working at the time, the crushings varying from 3dwt. to a little over 1oz. per ton. The Caps of the reefs showed a good deal of carbonate of copper, and the gold was soon found to be mixed with copper and iron pyrites. With economical working, Marengo and numerous other fields similarly situated will some day pay to work. One or two of the reefs are good enough to pay now, but could not bear by themselves the whole of the expenses necessary to put the field in going order. A goldfield in its infancy offers an exception to the usual laws of trade. The mines must bear in common the expenses of the machinery, &c., without which they are themselves worthless. Instead, therefore, of there being a struggle for existence, each individual miner is directly interested in his neighbour's prosperity.

Nebo (Mount Britton) Goldfield.

The reefs of the Mount Britton Goldfield occur partly in diorite and partly in grey and black shales and sandstones. The stratified rocks belong, like the Gympie Goldfield, to the Bowen River Beds (Carbonifero-Permian), and the igneous rocks appear to be partly interbedded and partly intrusive. The field was opened in 1881 as an alluvial "diggings," and has yielded some large nuggets—69oz., 50oz., 45oz., 40oz., and 35oz.)—with but a small proportion of fine gold. Two groups of reefs, one at the head of Nuggetty Gully and the other about three-quarters of a mile to the South, are being

worked, and have yielded some rich crushings. Except the totals for the different years, no returns have been furnished by the Wardens. In the latter half of 1883, the Little Wanderer Reef crushed 421 tons of stone for 2,416oz. of gold. A third group of reefs, near Mount Clarke, looks as if it might yet prove valuable.

YIELD OF MOUNT BRITTON GOLDFIELD.

Year.	Alluvial Gold.	Reef Gold.		Total Gold.
	Ounces.	Stone Crushed.	Gold Therefrom.	Ounces.
		Tons.	Ounces.	
1881	4,808	(No crushings.)		4,808
1882	625 ?	627	2,779	3,404
1883	520 ?	686	2,095	2,615
1884	800 ?	200	500	1,300
1885	—	(No returns.)		—
1886	say, 300	—	say, 50	350
1887	450	12	16	466
			Total	12,943

Yatton Goldfield.

The recently opened goldfield of Yatton is in a dioritic country rock, intersected by dykes of silicated felsite. Some of the auriferous reefs, such as the St. Catherine, follow the usual laws of such deposits, but the majority are peculiar as regards the conditions under which the gold is found. The gangue stuff (which is generally composed of brecciated lumps of diorite) is veined with calcite and decomposed concretionary carbonate of lime, and occasional aggregations of carbonate of iron (siderite) and decomposed orthoclase felspar are met with. Some of the stone, composed of mixed quartz and reddish ferruginous carbonate of lime, shows gold very freely. The gold is flakey, like gold leaf. The reefs are as yet too undeveloped to say much about. 136 tons crushed in 1877 gave 74ozs. of gold, but these figures give no idea of the yield of the field, as the richest parts of many of the reefs probably never passed through the stampers. A good deal of alluvial gold had been taken from Yatton seven years before the proclamation of the field. The reefs are not yet sufficiently developed to give a true idea of their value, as they are mostly of a character of which miners have had little experience.

Peak Downs Goldfield.

The reefs in this goldfield occur in an area of crumpled and fissured metamorphic schists, slates, &c., near the township of Clermont. Daintree, in his "Geology of Queensland" (Quart. Journ. Geol. Soc., vol. xxviii., p. 301), refers these rocks to the

Lower Silurian Series, or even to the still older metamorphic system of Victoria, but the only direct evidence of their age is that a bed of limestone, apparently of Devonian age (Burdekin Beds), appear to lie unconformably on them. "The principal reefing country lies to the South of Clermont, and extends from two to three miles West of Copperfield to Macdonald's Flat, a distance of about seven miles. The reefs have a general East and West trend. In none of them can the work be said to have gone beyond the prospecting stage. I must point out that the depth to which these reefs have been tried exceeds in no case 150ft. or 160ft., and only in a few cases has this depth been reached. The returns of the crushings, too, that have been kept do not give a fair account of their average yield of gold, for the returns of the earlier and best crushings have been lost. I certainly am of opinion that some of them will be found payable at deeper levels."

"Most, or I might say practically all, of the gold sent away from this field has been the yield of alluvial workings. Ever since the year 1862, when the first rush took place, thousands of ounces of alluvial gold have yearly been obtained. The returns of the gold sent away in earlier years have not been preserved. The yield, however, was much larger than of late years. This falling off has been caused, to a great extent, by the dearth of water."

In addition to diggings in the recent alluvia of the gullies on both sides of the Drummond Range, gold has been obtained in large quantities from drifts covered by a flow of basalt. "The Victoria Lead" has been, perhaps, the richest deposit of gold in the district. At the summit of the hill, where the workings on it started, the wash-dirt was only 15 or 20 feet deep. About three-quarters of a mile to the North, where it ran under the Basalt, it was 100 feet deep. Its average width is from 20 to 30 feet. A 30oz. Nugget was obtained from near the head of the lead. The Washdirt is said to have averaged 1½oz. to the load, all the way through, and 24 loads in one part went 8oz. per load. Daintree, in his "Geology of Queensland," says, with reference to the volcanic outbursts: "The more Northern Volcanic Areas, those shown on the map North of lat. 21°, are probably contemporaneous with the Upper Volcanic Series of the Victorian Geologist, and are probably of Pliocene Tertiary age. The Southern areas, viz., Peak and Darling Downs, &c., are older, agreeing with the Lower Volcanic of Victoria, which have been ejected through fissures, and have in no case a very extensive flow beyond the line of fracture through which they have issued. These may be referred to the Miocene epoch."

A still older, and in some respects a very remarkable, auriferous drift occurs in the Cement Hill, at Hurley's, and at the Four-Mile. Cement Hill is described as consisting of, "Firstly, from 15 to 30 feet, of a conglomerate, composed of boulders and pebbles of schists and small quartz pebbles, the whole cemented together by a clayey cement formed by the disintegration of the schists itself. This conglomerate

is soft, but very tough to work in. The bottom 4 or 5 feet forms the washdirt in which the gold is found. Secondly, underlying the conglomerate is a fine-grained silt or shale from 1 to 4 feet in thickness, termed by the miners 'dig,' which is cut away to facilitate the bringing down of the wash above. Lastly, another drift of smaller pebbles and not auriferous. This rests on the auriferous schists of the district. The 'dig' contains *Glossopteris*, the characteristic plant of the Bowen River and Newcastle (N.S.W.) Beds, and therefore the deposit appears to belong to Carbonifero-Permian Series. The auriferous portion of the upper conglomerate or drift is said to contain, as an average, about 5 or 6 dwts of gold per ton."*

Coal has been found beneath the basalt within a few miles of Clermont. The Peak Downs Copper deposits will be referred to under another head.

The Returns from the Peak Downs Goldfield are very imperfect. For the first 15 years of the history of the field I can only find one record by the Warden (of 4,900oz. escorted in 1867.) It cannot possibly be over the mark to fill up the blanks in the record as I have done by taking 4,000oz as the average Annual Yield from 1862 to 1866 inclusive, and 3,000oz. Annually from 1868 to 1876 inclusive. The recorded returns, with these additions, give a total yield of 104,483oz. of gold. Gold to the amount of 6,079oz. is returned as the yield of 12,266 tons of quartz crushed, but it must be remembered that Mr. Rands points out that the records of the earlier and richer crushings have been lost.

YIELD OF PEAK DOWNS GOLDFIELD.

Year.	Reef Gold.		Alluvial Gold.	Total Gold.	Remarks.
	Stone crushed. Tons.	Gold therefrom. Ozs.	Ozs.	Ozs.	
1862-1866	...	...	...	20,000 [1]	[1] Estimated.
1867	...	...	...	4,900 [2]	[2] Escorted.
1868-1876	...	...	...	27,000 [1]	
1877	...	...	...	3,000	
1878	2,673 [3]	1,670	2,330?	4,000	[3] From Macdonald's Flat Reefs alone.
1879	963	528	5,480?	6,000	
1880	2,293	1,089	6,311?	7,400	
1881	2,545	758	6,718	7,476	
1882	1,211	842	5,158	6,000	
1883	484	243	2,757	3,000	
1884	652	275	2,993	3,268	
1885	213	119	3,545	3,664	
1886	746	253	4,104	4,357	
1887	486	310	4,108	4,418	
		Total	... ...	104,483	

* W. H. Rand's "Report on the Geology and Mineral Deposits of the Country in the Vicinity of Clermont." Brisbane: By authority, 1886.

Raglan, Calliope, Norton, Cania, and Kroombit Goldfields.

The **Raglan Goldfield** has been in existence since 1867. At the Old Diggings, the Two-mile Diggings, and the Mount Larcombe Scrub, considerable quantities of alluvial gold have been obtained. The country-rock consists of grey and siliceous slates, and hardened sandstones or quartzites, with occasional conglomerates and limestones. The limestone contains few fossils, but crinoids are common, and a species of *Aviculopecten*, like *A. multiradiata*, has been detected by Mr. Rands. This species is common to the Devonian and the Gympie Beds; and the auriferous strata are probably of the age of the latter.

The Duke of Brittany Reef has yielded on an average a little over ½oz. of gold to the ton. About 1000oz. were obtained from the reef in a few years. Several other reefs have been worked from time to time. A copper lode has been opened up near the "Old Diggings."

Calliope Goldfield was discovered in 1863. "Gold has been obtained in fair quantities in the beds of nearly all the gullies heading from the Boyne Range. Amongst those on the Calliope falls are the Nuggetty Gully, Dogleg Gully, 'Ten Men's' Gully, and Gordon's Gully, all of which run Westward into Oakey Creek, in Brennan's Flat. The gullies at the head of Brennan's Flat have also yielded gold, and in a gully close to the Sheep Station and running East a great amount of work has been done; the washdirt here was 10 to 12 feet deep On the slope of the hill patches of alluvial of an older date than that in the gullies are now being worked."

"Nuggetty Gully, although very patchy, has been the most productive. In 1866, nearly 600 men were at work in this gully alone. The number had decreased to about 200 two years later on. Many nuggets, up to 5oz., have been picked up; and an American Black is reported to have picked up nuggets weighing 14oz. and 73oz. respectively.

"On the eastern or Boyne side of the watershed are Machine Creek, Tucker's Gully, Pancake Gully, and New Zealand Gully. The latter, which was started in 1863, has been by far the most productive. A large number of men were employed in it in 1872.

"From over 800 men in the year 1864, the number has gradually fallen so that now (1885) scarcely a score are at present at work on the field. The future of Calliope will depend, therefore, rather on its reefs than on its alluvial deposits.

"The formation consists of metamorphosed rocks, chiefly of altered grey and greenish slates, with numerous outcrops of limestone and marble." These have yielded no recognisable fossils. "The country-rock is intersected by dykes and patches of serpentine diorite and porphyry."

Mr. Rands, in his report, gives descriptions of the Theresa, King's Gully, The Company's, Perseverance, Connemara, John Bull, Alexandra, Mitchell, and Woods' Reefs, and observes that "up to the

present time none of the reefs have had a fair trial. The deepest shaft is not more than 100 feet in depth; and, from the information I could gather, some of them at any rate have been abandoned for reasons such as want of capital, bad management, high rates for crushing, &c., and not because they did not contain gold in payable quantities, if worked in a judicious and economical manner."

The **Norton Goldfield** is at present the most prosperous of the group, probably for the reason that it has been fortunate enough to attract the attention of men of energy and skill. It was discovered in 1871, but little work was done till 1879, when a Machine was erected.

The formation is a grey, medium-grained granite, which passes in places into syenite and in others into porphyry.

"The granite is in the form of an eruptive 'boss,' which rises through and sends out veins into the surrounding slate country."

"The granite is intersected by gold-bearing reefs and volcanic dykes of diorite, porphyry, and dolerite."

Mr. Rands describes minutely the Advance, Who'd-have-thought-it, Emu, Never Never, Little Wonder, Chandler's, Martin's, All Nations, Galena, and other reefs. In these the gold is associated with iron pyrites, arsenical pyrites, zinc-blende, galena, stibnite (sulphide of antimony), quartz, and calcite. From 1879 to 1884 inclusive, 2,766 tons of stone were crushed for 7,883oz. of gold, but the treatment of the complex mundic proved the chief drawback to the development of the field. Lately, chlorination has been successfully applied to the treatment of the stone, and the field will probably develop steadily in future.

The country-rock of the **Cania Goldfield** is described by Mr. Rands as consisting of alternate layers of sandstone, slates, and limestone, the latter of a pisolitic structure and in parts fossiliferous. These rocks are capped by denuded tablelands of "Desert limestone." The limestones have yielded corals and *brachiopoda*, which render it almost certain that the auriferous strata belong to the same age as the Gympie Beds (Carbonifero-Permian).

"Colours of gold can be obtained from the drift in the beds of any of the creeks or gullies in the district, and most of them have been worked more or less. On the Cania or Three Moon Creek side of the watershed, the principal workings are the Four-mile Creek and its gullies. This creek has yielded large amounts of gold in rich patches, but it is not at all evenly distributed, and the beds cannot be followed any distance. Lower down on the same or west side of the creek is the Moonlight Gully, which has given perhaps the best yields on the field, the gold being evenly distributed along the whole length of it. This and also the Chinaman's, Starlight, and Daylight Gullies all head from the same hill, around the foot of which the Three Moon Creek bends. Several reefs occur on this hill, some of which are being worked. On the other side of the creek, Paddy's Gully has proved the best."

In the "Mount Rose" Reef the gold is in white quartz; near the surface it was found in calcite. It is "met with in very rich patches, and at times over 100oz. have been broken down in one patch. All the gold in this reef is coarse in character." The "Garry Owen" and Mount Hope Reefs crushed over 2oz. to the ton.

"The **Kroombit** diggings, on the other side of the watershed and west of Cania, were discovered in February, 1870, just a month before Cania was opened. Of the gullies on these falls the Roan Colt and Denny's have, perhaps, proved the best. They head from a small round hill which is itself partially covered with alluvial drift to a depth of 20 feet, which has yielded a fair amount of gold. There is another round-shaped hill about a mile to the east, which has also a similar drift on its summit. Gullies running also from the hill have been payable to work. The drift on these two hills is evidently of a date anterior to that found in the beds of the present creek or gullies. It is probably of Post-Tertiary age."

The above quotations are from Mr. Rand's "Report on the Goldfields of Raglan, Calliope, Milton (Norton), and Cania, &c" Brisbane: By authority, 1885.

The returns from these fields are very incomplete. Prior to 1877 I have only been able to find records of the output of 1866 and 1868. The best years of the alluvial diggings, as will be seen from Mr. Rand's report, are omitted. An estimate of 2,000oz. per annum for the eleven omitted years is probably well within the mark, and this, with the recorded output, brings the total yield up to 57,510oz.

YIELD OF RAGLAN, CALLIOPE, NORTON, CANIA AND KROOMBIT GOLDFIELDS.

Year.	Stone Crushed.	Yi ld therefrom.	Alluvial.	Total.
	Tons.	Oz. Gold.	Oz. Gold.	Oz. Gold.
1863 to 1865	...	...	...	say 6,000
1866	...	...	...	3,235
1868	...	...	...	3,960
1869 to 1876	...	...	...	16,000
1877	107	1,209	791?	2,000
1878	222	956	329?	1,285
1879	926	1,517	...	1,517
1880	785	3,430	...	3,430
1881	823	2,072	998?	3,070
1882	...	No returns.	...	3,996
1883	463	1,172	594	1,766
1884	817	1,550	583	2,133
1885	687	1,469	631	2,100
1886	841	2,166	1,072	3,238
1887	1,067	2,610	1,170	3,780
Total	...	...	...	57,510

Rockhampton Goldfields.

Mount Morgan, Crocodile, Rosewood, Morinish, Ridgelands, and Cawarral.

For the last five years the Rockhampton goldfields have practically meant Mount Morgan, that wonderful mine having dwarfed everything else in the district into comparative insignificance. Mount Morgan is a dome-shaped elevation, rising to about 1,200ft. above the level of the sea, and about 500ft. above the surrounding tableland.

The tableland is composed of bluish-grey quartzites—fine-grained siliceous sandstones, more or less vitrified—full of minute crystals of iron pyrites, and specks of magnetic iron ore, greywacke of the ordinary type, hard fine-grained sandstones of mingled siliceous and felspathic materials, occasional masses of shale hardened to a flinty consistency, and a few belts of serpentine. The recent labours of Mr. James Smith, of Rockhampton, have brought to light in these rocks an abundant fauna, of species which prove conclusively that they are part of the same series (Carbonifero-Permian) with the auriferous rocks of Gympie.

The stratified rocks are intersected in every direction by dykes and other intrusive masses of dolerite, rhyolite, and other igneous rocks—the intrusive masses occupying apparently as much space as the remnant of the original stratified formation itself. This country rock is traversed by reefs of the usual description, some of which, though not large, give a high yield of gold per ton.

The upper portion of Mount Morgan consists of a deposit varying from red and brown hæmatite on the one hand to a frothy, spongy cellular siliceous sinter on the other. Fine gold is disseminated throughout the mass, but it varies considerably in richness. The average of late is said to be about 7oz. per ton. The gold is the purest in the world, being absolutely free from silver. The mining operations are simply quarrying, and are consequently inexpensive. The stone is treated by chlorination, and it appears that for years to come the output depends simply on the amount of stone that can be put through the process. With the present plant 1,500 tons per week are manipulated. The mine is held by a company of one million shares, and the present selling price proves a belief on the part of investors that the mine is worth £16,000,000.

The origin of this unique auriferous deposit has given rise to many speculations. My belief is that it is due to a geyser or hot spring which burst out in Tertiary times after the valley of the Dee had been carved out of the cake of "Desert Sandstone," which once covered the site of the Mountain, and whose escarpments now look down on the valley. Mr. J. Macdonald Cameron, M.P., who reported

on the mine in 1887, considered the deposit to be "one mass of tufaceous material from which some of the alkaline constituents of its felspar were washed out by aqueous percolations."

Mr. Cameron continues: "Previous to the upheaval by the igneous disturbances that have also metamorphosed the once stratified rocks of the district, I picture to myself group after group of quartz veins of auriferous mundic, varying in width and richness, traversing and intersecting their various lines of stratification. Igneous disturbances follow, that disturb and upheave their once regular masses with abrupt cliffs and prominences. Their sandstones are converted into quartzites, their soft argillo-arenaceous slates, with their auriferous veins of mundic-charged quartz, are converted into more crystalline and compact rocks, from which every trace of stratification has been eliminated. Even the quartz itself becomes more crystalline, and the sulphur of its contained mundic is partially, and in some cases wholly, oxidised—the extent of oxidation being lesser or greater in proportion as the masses of igneous matter were intrusive or eruptive. If the former, and my theory, on further examination of the district be found correct, then the sulphurous condition will continue to 'make' the further we recede from the metamorphic, until the original mundic lode group is reached; but if the latter, metamorphism of the lode-stuff may continue, even to an unworkable depth, which would be a matter for congratulation rather than regret, as in this case natural forces will have continued to do for the auriferous ore of Mount Morgan, what would otherwise require the skill of the chemist, with a consequent increased cost of treatment."

At present the mine next in importance to Mount Morgan, in this district, appears to be the Taranganba, on the coast near Yeppoon, although it still awaits development. The owners propose to erect a plant capable of treating 1,500 tons per week. Mr. J. A. H. T. Ranft, M.E., in a Report on the property, describes the "country rock" as consisting of "bands of quartzite, chert, lydianstone, hornstone, jasper, greasy quartz, milky quartz, ferruginous and granular quartz, intersections of ferruginous veins and bands, in which limonite forms no small portion. These rocks have been intersected by a number of dykes, all of which have a strike nearly magnetic north (N. 4 W.), and it is to these dykes that the auriferous charging of the rocks is due." By assay of specimens taken from a number of places, Mr. Ranft calculates that large areas of the rocks adjacent to the (porphyry) dykes will pay well for raising and chlorinating.

The **Crocodile Goldfield** lies at the foot of the North-West escarpment of the tableland on which Mount Morgan is situated, and can hardly be more than from 1 to 300 feet above the sea level, on the heads of Gavial Creek, which falls into Keppel Bay (thus proving, by the way, the falsity of an obstinate superstition among miners to the effect that payable gold *cannot* be found on the East coast). This belief, or rather its logical inference that any gold found on the East

Coast cannot be payable, has exerted a powerful depressing influence on all such shows, as miners could hardly be induced to give them a trial. The prevailing country-rock is granite or syenite, and in this are the "Hector," "Who'd-ha'-thought-it," "Block and Pillar", "Hit or Miss," and other reefs. The "St. Gothard" and "Bonanza" are in altered stratified rocks—slates, greywackes, grits, and conglomerates—intersected by diorite dykes.

At the **Rosewood Goldfield,** the "Golden Bar" reef is composed for the most part of calcspar and chlorite in pockets, and coating crystals of calcite. Sometimes there is also a good deal of quartz, and crystalline pyrites occurs in films on the surface of the veins. Some very rich bunches of gold have been obtained in calcspar veins in this mine.

The reef occurs in a diorite dyke, which is mostly altered to chlorite. Rich bunches have also been obtained in the Caledonian reef, a large body of quartz with patches and pockets of chlorite, intersecting highly altered sandstone country.

At **Blackfellow's Gully** three reefs, the "Homeward Bound," "Carnarvon Castle," and "Mary Florence" have been worked.

At **Morinish** the "Welcome" Reef has been worked to a depth of over 350ft. in a country-rock of fine-grained serpentinous greywacke. The reef is of quartz, with iron pyrites, arsenical pyrites, a little galena, and a very little zinc blende. It has been worked for many years with fair success.

At **New Zealand Gully** is the "North Star Mine," in porphyry country.

At **Cawarral** the "Galawa," "Annie," "Helena," and "Annie Halliday," in serpentine country, have yielded good returns.

Most of these small fields have yielded a good deal of alluvial gold. A nugget weighing 258oz. 11dwts. was found at Mount Wheeler (Cawarral).

The output of the various Rockhampton Goldfields cannot be correctly given, as the earlier records are lost in the mists of an antiquity of thirty years. In 1866, the Warden estimated the amount of gold at 1,000oz. per week—52,000oz. for the year. In 1867, the amount is given at 33,739oz. In 1868, the total is given at 25,505oz., of which 8,982oz. were the yield of 7,564 tons of stone crushed. A total of 111,244oz. is thus accounted for in three of the years previous to 1877, when Returns began to be regularly published. It is probably well within the mark to assume that the total yield for the period amounted to about 200,000oz. From 1877 to 1887 inclusive, the total amount of gold produced was 187,257oz., of which the greater part must be credited to Mount Morgan.

YIELD OF ROCKHAMPTON GOLDFIELDS.

Year.	Stone Crushed.	Yield therefrom.	Alluvial.	Total.
	Tons.	oz. gold.	oz. gold.	oz. gold.
1866	...	...	...	52,000
1867	...	...	...	33,739
1868	7,564	8,982	...	25,505
				111,244
Estimated amount prior to 1877 ...	...	...	...	88,756
Total ...	...	...	...	200,000
1877	...	...	...	2,350
1878	1,120	733	...	2,071
1879	...	...	...	707
1880	...	...	...	1,353
1881	...	..	...	2,132
1882	1,092	2,016	...	2,107
1883	...	...	...	5,591
1884	...	...	...	22,159
1885	...	...	...	14,396
1886	...	49,086	...	49,086
1887	17,645	85,205	100	85,305
Total ...	...	...	...	187,257

Mount Shamrock Goldfield.

This Goldfield has only recently been opened, and its output appears for the first time in 1877, as 3,348oz. of gold from 3,151 tons of stone crushed. In the same year five tons of Bismuth ore were exported.

Mount Shamrock is a low hill about 145 feet in height above the level of Didcot Creek, which runs at its foot on the eastern side. The hill consists almost entirely of a dark colored massive slate, which is intersected by dykes of porphyry. It was on the summit of this hill, close to where their shaft now is, that the prospectors first discovered the gold in a piece of iron-stained stone lying at the surface.

MOUNT SHAMROCK PROSPECTING CLAIM.

In a shaft 30 feet deep, "the following materials were passed through, in the order mentioned, in layers, all of which were dipping away steeply to the east:—

"1. A breccia consisting of angular fragments of a fine-grained aluminous and siliceous rock, cemented together with a hard cement of oxide of iron and silica, throughout which are numerous blebs of quartz.

"2. A yellow ochre containing a fair percentage of oxide of bismuth.

"3. A brown iron ochre with veins of crystallised glassy quartz running through it.

"These ochres form the principal part of what has been passed through in the shaft. The two together must be at least 8 feet to 10 feet in width, and they contain numerous veins and bunches of oxide of bismuth.

"4. Earthy red hæmatite, with siliceous veins containing also broken particles and blebs of glassy quartz.

"All these materials contain gold in considerable quantity, the gold in some places being beautifully crystallised."

"Much doubt has been experienced as to the nature of this deposit. Both from the character of the stone and the regular manner in which it strikes and dips, I am of opinion that it is a lode, the breccia being formed by the breaking up and subsequent cementing together of particles of the walls and matrix of the lode. The fissure in which the lode is formed appears to have acted as the channel for the passage of water of hot springs to the surface, for all the materials, the crystallised gold, the hard siliceous and iron cement of the breccia, and the ochreous materials are such as would have only been formed by deposition from solution in water.

"The gold appears to be especially associated with the bismuth, for the veins of oxide of bismuth are exceptionally rich. A small sample of the oxide assayed by Mr. Hamilton contained 62 per cent. of metallic bismuth and 252oz. of gold per ton of the material.

"A dyke of white felspar-porphyry can be traced down the hill from a point immediately south of the shaft in a West-North-West direction. It is very probable that this dyke may have influenced the richness of the lode at this point.

"In No. 1 and No. 2 North small quantities of gold have been found associated with the porphyry dyke.

"Mount Melville consists of massive blue slates and hardened sandstones, intersected by dykes of felspar-porphyry of a similar character, and probably a continuation of those met with in the northern part of Mount Shamrock. A sample taken from the outcrop yielded gold equal to about 2oz. 12dwts. 13grs. to the ton, but a trial crushing of 31cwts. yielded only 4dwts., or a little over $2\frac{1}{2}$dwts. to the ton.

"At the foot of this hill a small reef is being worked. It is from 2 to 10 inches wide, consisting of quartz with a large percentage of the oxide of iron and manganese. At the bottom of the shaft, in one place, there is a vein 1 inch wide consisting almost entirely of pyrolusite (oxide of manganese.) An assay from this reef gave 16dwts. of gold and 6oz. of silver per ton. It intersects a dyke of porphyry. The footwall is of dolerite."

"At Mount Ophir is a large reef of white translucent quartz, stained in patches with oxide of iron. It contains a good deal of molybdenite and specks of iron pyrites. At 25 feet a hole was drilled into the reef; the *débris* obtained from the hole, on being

washed, gave a very good prospect indeed. The rock of which this—the northern—side of Mount Ophir consists is made of fine felspathic dust containing small and more or less rounded particles of a micro-crystalline felspathic rock. Fine gold is obtained on crushing and washing pieces of this rock." (Report "On the Gold and Silver Deposits in the neighbourhood of Mount Shamrock." By W. H. Rands. Brisbane: By authority, 1886.)

Mr. Rands, in the Report above quoted, gives an account of the Old Chowey Reefs and Stanton-Harcourt alluvial diggings, and of the "Allendale," "Hannan's," "Union," "Lady Mary," and other silver lodes. The argentiferous lead ores are associated with arsenical pyrites and zinc-blende. Mr. Rands observes: "The amount of silver in the lodes, as far as assays have at present shown, is small—only from 30oz. to 40oz. to the ton, which of itself will not pay to work, especially with a narrow reef. They all contain some gold. In the "Allendale," which is the only shaft well into the sulphides, the ore contains as much as 1oz. of gold to the ton. In 1886, the amount of ore raised was 75 tons, valued at £1,350. In 1887 the return was *nil.*"

Eidsvold Goldfield.

"The country-rock round about Eidsvold consists of granite, which for the most part is medium-grained, of a pinkish-brown colour. Its constituents are orthoclase felspar, largish blebs of quartz, with small crystals of mica (biotite). The rock passes in parts into a fine-grained syenitic granite of a darkish colour, and contains hornblende in addition to mica.

"The reefs are situated in the granite country. They are running in various directions, though the majority of them have a North-West to North-North-West bearing. They lie very flatly in most cases, the underlie varying from 45deg. to 75deg.

"All the reefs contain a certain amount of mundic; and, as the water level has not yet been reached, the quartz is often of an ochreous or gossany nature from the decomposition of the sulphurets. It is probable that the reefs will be rich in sulphurets at a depth.

"Eidsvold, in many respects, somewhat resembles the Charters Towers Goldfield. The chief points of resemblance are—the country-rock, which in both places consists to a great extent of granite and syenite or syenitic granite; in the flat underlie of the reefs; and in the character of the gangue of the reefs, which consists in both places, to a great extent, of decomposed granite *débris* with veins of quartz.

"Comparatively small amounts of the sulphurets (pyrites and galena, &c.) have yet been met with in the Eidsvold reefs, owing, no doubt, to the fact that the workings have not yet reached beyond the action of atmospheric influences. The quartz, however, is often ferruginous, and contains a yellow ochreous material which has been produced by the decomposition of these sulphurets, which will be

found to exist in larger quantities in the reefs when the water level is reached. A few of the reefs contain a good percentage of galena, a mineral of very common occurrence in the Charters Towers Reefs. Very little copper ore occurs in the reefs. On the other hand, arsenical pyrites is of common occurrence here in some reefs. Mr. Jack says in his report on Charters Towers: 'Arsenic is scarcely known in any form on the field.' I did not meet with any zinc ore at Eidsvold, while sphalerite (zinc-blende) is of common occurrence at the Towers.

"The field, as far as can be gathered from surface indications, is, with the exception of a few porphyry and syenite dykes, singularly free from eruptive dykes.

"So far as can be judged from the work already done, the prospects of Eidsvold as a reefing district are very good.

"The field will soon have the advantage of a thorough trial, for two or three batteries will soon be on the field. ("Report on the Eidsvold Goldfield," by William H. Rands, Assistant Government Geologist. Brisbane: By authority, 1887.)

In the Report above quoted, Mr. Rands gives detailed descriptions of the several reefs, and mentions the occurrence of tin ore (cassiterite) in one of them, associated with tourmaline, and of stibnite (sulphide of antimony) in another.

Up to the end of 1887, only 27 tons of stone had been crushed, for a yield of 84oz. of gold.

Brovinia Goldfield.

The existence of gold in this locality has been known for many years. It was, however, only in 1886 that the reward was claimed for the discovery of payable gold. There are five reefs in the May Queen Claim. 10 tons of stone sent to Gympie gave a return of 1oz. 14dwts. of gold per ton. Machinery is about to be erected on the field.

Gympie Goldfield.

Gympie stands next to Charters Towers in importance among the goldfields of the Colony, although the auriferous rocks occupy a very limited area. The Country-rock is a series of strata which dip at an average angle of 22deg. a little to the North of East. The uppermost bed of the auriferous veins is a limestone. The Grey shales and Sandstones above the limestone appear to be entirely out of the goldfield.

The auriferous rocks beneath the limestone consist of grey shales, black pyritous shales, greywackes, sandstones, grits, and conglomerates. The Sandstones are often slightly calcareous. The conglomerates are masses of pebbles or boulders of all sizes up to a foot in diameter. The boulders and pebbles are generally well rounded, but in many cases the angular condition of the fragments in

the grits and conglomerates suggests a volcanic origin. It is remarkable that the strata of the field present alternations of sedimentary rocks which have undergone no alteration with others which have become indurated and semi-crystalline.

The richest deposits of gold occur in the reefs where the latter intersect the pyritous black shale or slate country. Gympie, in this respect, presents the clearest case known to me of the segregation of the gold from the adjacent rock. The matrix of the gold is generally quartz, but not unfrequently calcite.

The limestone, shales, and calcareous sandstones have yielded an abundant fossil fauna, sufficient to prove that the Gympie Goldfield is a locally-metamorphosed portion of the Bowen River Beds (Carbonifero-Permian), the equivalent of the Newcastle (New South Wales) Coalfield.

The Greenstone of Gympie has long formed a subject of controversy. There are some intrusive dark-green crystalline rocks on the field which were probably once dolerites or diorites, but, even in microscopic sections, these rocks are much altered and "masked" by viridite. A good deal of the "Greenstone" is probably derived from the metamorphism of sedimentary or ashy rocks, while a considerable amount of confusion has been caused by the habit of calling any greenish rock a "greenstone."

The majority of the principal reefs, such as the Great Eastern, Glanmire, Columbia, Wiltshire, Smithfield, Willmott, Phœnix, March, Golden Crown, Maori, Alma, Lady Mary, Caledonia, Hilton, California, Nil Desperandum, Louisa, Perseverance, Excelsior, and Alliance, have a general North or North-North-West bearing, and underlie to the east, with an inclination which is nearly at right-angles to the dip of the strata. The Helen Hawkins has a North and South bearing, but underlies to the West at 65deg. The most important cross-reefs are the Monkland, which bears North-West and underlies South-West, and the Inglewood, which bears North-North-West and underlies North-North-East.

The field is disturbed by several important faults. One of these, in the line of Phœnix Street, is calculated (from the displacement of the outcrop of the limestone bed) to have a downthrow of 528ft. to the North. None of the reefs on the North side of the fault are recognised with certainty on the South side.

The field has been examined in great detail by Mr. W. H. Rands, whose report, now nearly ready, will probably form the most important memoir yet published on Queensland Geology.

In the early days a good deal of alluvial gold was obtained, but this is now a thing of the past. The total amount of gold produced is estimated at 1,323,412oz. This includes the output of Kilkivan and Black Snake, which, however, is too small to interfere seriously with the total.

Yield of Gympie Goldfield.

Year.	Reef Gold.		Alluvial Gold.	Total Gold.	Remarks.
	Stone Crushed.	Gold therefrom.			
	Tons.	oz.	oz.	oz.	
1867 to 1875	...	...	...	544,914[1]	[1] Deduced from figures in Report of Department of Mines for 1884, p. 11.
1876	...	...	...	36,232	[2] Includes Pyrites, Tailings, and Alluvial.
1877	19,331	43,854	...	43,854	[3] Includes Pyrites, Tailings and Alluvial.(?)
1878	22,358	40,320	1,244[2]	41,564	[4] Alluvial only. (?)
1879	26,383	36,799	1,654[3]	38,453	[5] Pyrites, &c.
1880	22,562	39,511	3,561[3]	43,072	[6] Pyrites, &c. (?)
1881	30,066	65,654	2,207[3]	67,861	
1882	44,720	50,162	150[4]	50,312	
1883	56,980	64,818	Nil	64,818	
1884	62,085	112,051	Nil	112,051	
1885	84,146	86,832	2,700[5]	89,532	
1886	103,946	88,450	150[6]	88,600	
1887	90,673	96,940	5,209[3]	102,149	
Total ...	...	...	...	1,323,412oz	

Kilkivan and Black Snake.

"Most of the work at **Kilkivan** has been the driving of tunnels in a sheet of White porphyry, which occurs in the face of a range running North and South. The porphyry varies greatly in thickness. There are no defined reefs at all in the porphyry, but only minute veins of quartz with oxides of Iron and Manganese. Where the manganese dioxide occurs the veins are the richest in gold. In some parts of the porphyry these veins are very numerous, and the veins are very patchy. Where these patches occur, however, the whole of the mass will pay to crush. No large quantity of stone can be obtained. Two men who have been working in the Long Tunnel P.C., which is considered the best claim in the porphyry, after six months' work, have just had a crushing of $8\frac{1}{2}$ tons for 24oz. of smelted gold. The cost of carting and crushing alone was £3 per ton.

"The country around Kilkivan consists entirely of metamorphic rocks, such as serpentine, hornblendic and micaceous schists. All the reefs found in this district occur in these rocks. From the Rise and Shine Reef very good specimens of gold in the quartz were obtained in the upper part. Lower down the stone changes to a Mundic consisting greatly of zinc blende with some iron pyrites and a little galena.

"The country between Kilkivan and the Black Snake, and Mount Coora is entirely of schists—chiefly hornblendic—and mica-schists, which have a steep inclination to the North West.

"The gold-bearing reefs of the **Black Snake** district occur in a micaceous porphyrite. This rock consists of a felsitic base with

porphyritic crystals of oligoclase felspar and mica, some pyrites, and here and there viridite and chlorite from the decomposition of some of the original constituents of the rock. This rock occupies a small area of about 3 square miles. The reefs generally have a North-West bearing and are perpendicular, or have a slight underlie to the East or South-East. The ores from these reefs are complex; in the Mariner's Reef, for instance, at a small depth the ore consists of iron, copper, arsenical pyrites, silver-lead ore (galena), and a small amount of sulphide of antimony. The gold in this ore was equal to a little over 1oz per ton. The silver to about 25oz. per ton. Copper, as carbonate or sulphide, is met with, sometimes sufficiently rich to smelt. 50 tons from the Rose, Shamrock and Thistle Reef were sold to the Mount Coora Copper Mining Company.

"Outside this area of porphyrite, Northward towards Mount Coora, are altered rocks consisting of serpentine and of an altered volcanic rock, probably an altered dolerite. The whole area was most probably of the same volcanic rocks, parts of which have undergone a greater change. It is in these rocks that the Mount Coora and Mount Clara Copper lodes occur.

"The Black Snake is now almost entirely deserted. This state of affairs is due, in my opinion, not so much to the poverty of the reefs, as to the fact that the land, having become private property, is closed to general enterprise. This field has, moreover, got a bad name owing to the investment of a large amount of capital in erecting furnaces and extravagant crushing plants instead of in the mines themselves." (W. H. Rands in Report of the Department of Mines for 1885.)

In "Report on the Geology and Mineral Resources of the Districts of Kilkivan and the Black Snake" (Brisbane: By authority, 1886), Mr. Rands describes the Rise and Shine (which has given 2,760oz. of gold from 1,336 tons of stone), Morning Star, Welcome, Perseverance, and New Year's Reefs at Kilkivan, and the Rose, Shamrock and Thistle, Tableland, New Zealand, Black Snake, Homeward Bound, Mariner's and Victoria Reefs at Black Snake. Of the Black Snake Reefs, Mr. Rands observes: "Judging from specimens of ore I saw, and also from assays of samples, there can be no doubt as to the high value of the ores in this district, and as the reefs generally are of a good average width, some of them, at any rate, should pay well to work. The ore would require special and expensive treatment to extract the gold and other metals of commercial value, and it would probably be found advisable to merely concentrate them on the field and send them elsewhere for treatment."

Important copper lodes occur in the Black Snake district at Mount Coora and Mount Clara and other localities, but are not now worked.

Cobalt and Nickel ores are also found in the district. The deposits will be described in the paragraph relating to the Kilkivan Mercury Mines.

Tenningering, Boolboonda, Molangul, and Normanby Goldfields.

The Reid's Creek Reefs are about five miles South-South-West of Mount Perry, on Branch Creek, a tributary of Reid's Creek. These reefs, Mr. Israel Bennett informs me, have turned out "during the last twelve years" (though I gather from the Annual Reports of the Department that they have only been worked since 1881) 400 tons of stone, valued at £15 per ton, £6,000, and 1,200oz. of gold, valued at £3 10s. per ounce, £4,200; total, £10,200. At a depth the lodes yield a mundic consisting chiefly of arsenical iron pyrites, but containing also iron pyrites and zinc-blende, with here and there blocks of galena.

None of the other smaller fields in the Burnett District have ever attained to much importance, and it would be impossible to estimate their yield with any degree of accuracy. They are grouped together in the Official Returns, sometimes under one heading and sometimes under another. The little field which produced all the gold in one year's Return was perhaps abandoned the next, so that the goldmines of the whole Burnett district have to be regarded as one group. Probably even thus the Returns are unsatisfactory. For instance, Mr. Rands in his "Report," published in 1885, gives the output for 1884 of the Reid's Creek mines *alone* as 688ozs. of gold from 830 tons of stone, while the Output of the whole district for the year is given in the Annual Report of the Department of Mines as 431ozs. from 603 tons.

Yield of Tenningering and other Small Goldfields in Burnett District.

Year.	Stone Crushed.	Gold Therefrom.	Total Gold.
	Tons.	Ounces.	Ounces.
1880	—	—	63
1881	1,809	1,254	1,254
1882	889	622	622
1883	355	376	376
1884	603	431	431
1885	127	92	92
1886	1,066	90	90
1887	1,202	496	496
		Total	3,424

Jimna and Gooroomjam Goldfields.

Jimna goldfield has been worked off and on for more than twenty years, but has not been highly productive, except at first, for

alluvial gold. Its output, when reported, has generally been massed in the Annual Returns with those of "Other Small Fields."

"The rocks at the Jimna Diggings are principally granite, slate, and sandstone, with comparatively little quartz. The alluvial drift of the only two creeks that have been worked—"Jimna" and "Sandy Creeks"—rests sometimes on decomposed granite, and sometimes on Sandstone or slate. The workings have extended four or five miles down each of these Creeks." Mortimore's reef, on Jimna Creek, contains fine gold. It is interesting as having been the first auriferous reef observed in the colonies traversing granite country.

Gooroomjam is situated on that portion of the Bunya Range which divides the sources of the Brisbane River from those of the Burnett. The diggings are confined to two gullies that descend from either side of the range. Monarrumbi Creek is worked for about half a mile in length, and the "Dry Gully" for even a less distance than this. The area mined upon consists entirely of greenstone, with the exception of the lower portion of the workings on Monarrumbi Creek, where massive hornblendic slates crop out at the foot of the range on the North side of the Creek, and granite on the point of the spur constituting the South bank. But I believe that the little quantity of gold found here has travelled from the tract of greenstone above, and that the whole of the gold has been derived from this latter rock. The only instances of vein quartz, locally termed "reefs," were in the "Wild Horse" and "White's" Claims, both being in greenstone. (Aplin, "Report of the Government Geologist, Southern Division." Brisbane: By authority, 1869.)

Warwick Goldfields.

Lucky Valley, Talgai, Canal Creek, and Pikedale.

These small goldfields have never attained to any importance. Mr. D'Oyly H. Aplin, in his "Report on the auriferous country of the Upper Condamine" (Brisbane: By authority, 1869), says:—"Talgai, Thane's Creek, and Canal Creek, are comprised within one continuous area of similar formation (probably Lower Silurian),* but between this and its eastern development at Lucky Valley there intervenes, along the immediate valley of the Condamine, a strip of about 25 miles of country occupied by Sandstones, Gravels, and conglomerates, belonging to the Coal Measure Series."

Lucky Valley is entirely an alluvial "diggings."

Copper lodes, as well as auriferous mundic-reefs, occur at Pikedale.

In a quartz vein on Duffer Gully (Lucky Valley) there are found "small, bright foliated metallic plates and scales of Tellurium, in which gold may be seen imbedded." (Aplin.)

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* Mr. Aplin does not give a list of the fossils on which this determination is based, and says that "in general aspect they resemble the fossils of Gympie." The latter are Carbonifero-Permian.

YIELD OF WARWICK GOLDFIELDS.

Year.	Stone Crushed.	Yield Therefrom.	Alluvial.	Total.
	Tons.	Oz. Gold.	Oz. Gold.	
1867	790	988	...	988
1868 to 1876	...	no returns.	no returns.	...
1877	325	390	no returns.	390
1878	572	736	no returns.	736
1879	40	60	...	60
1880	199	160	no returns.	160
1881	416	326	no returns.	326
1882	648	648	no returns.	648
1883 to 1886	...	no returns.	no returns.	...
1887	48	72	485	557
Total	...	...	...	3,865

SILVER FIELDS.

Mount Albion Silver Field.

West of the stanniferous porphyritic and granitic country of Herberton and Watsonville a band of stratified rocks stretches North-Westward from the head of the Dry River. They consist, for the most part, of shales and siliceous grits, the latter occasionally altered so as to be almost quartzites. Their general strike appears to be from North and South to North-North-West and South-South-East, but at Mount Albion itself, which is the most highly mineralised portion of the district, the rocks (among which siliceous grits predominate) have been minced up by innumerable faults into small segments, in each of which the strata have their own peculiar dip. In the Mount Albion Mine some sandstones are marked with reed-like plant impressions, but nothing has yet been discovered sufficiently distinct to afford any evidence as to the age of the deposits.

In the principal mines on Mount Albion—viz., the Albion, Lady Jane, and Barossa—immense deposits of ore occur in a very irregular manner. It appears that the faults are even more numerous than the evidence observable at the surface would indicate, and that the ore has filled up fissures formed by faults which intersect one another in every direction, so that there are no definite walls which can be followed for any distance. The ores are earthy and ferruginous, with argentiferous lead oxides and carbonates, and probably a good deal of silver chloride in fine particles accounts for their occasional extraordinary richness (six or seven hundred ounces of silver to the ton). Large Plugs of Horn Silver are met with from time to time in the workings. In the Albion some were obtained at the surface and at 19 feet. In the Lady Jane some were obtained at the 130 and 180 feet levels. The mines have not yet reached the water level, which is probably

low, the Mount being well drained by the faults which intersect it in every direction. Iron and lead oxides and carbonates, therefore, predominate, sulphide and sulphate ores forming, except in the Barossa (where the Galena is associated with Zinc Blende), only a small proportion of the ore.

In marked contrast to the deposits of ore on Mount Albion are those which occur about a mile and a half to the South-East. A large lode, the Silverhill, which might be taken as a typical example of what is meant by a true fissure lode, runs North and South through slate country, underlying at 45 degrees to the West. It is distinctly traceable, across two hills and two gullies, for a distance of 1,500 feet, by occasional exposures of galena. In the workings the galena ore runs from 9 inches to 3 feet in thickness, is occasionally associated with Anglesite, Zinc blende and Pyrites, and is accompanied by a brecciform gangue of broken country-rock. The ore, although more than payable, is not nearly so rich in silver as that of Mount Albion. The mines at the Orient Camp, six miles North-East of Mount Albion, produce a similar class of ore to that of Silverhill.

Smelting Works have been erected on Cummings' Creek, Mount Albion, by Messrs. John Moffatt & Co., and the ores have been very successfully treated. The earthy ores of Mount Albion are mixed in due proportions with the galena ores of the Orient and Silverhill, and with ironstone and limestone from the Dry River. The bullion is cast into ingots of lead containing generally about 600 ounces of silver to the ton and exported in this form.

Some confusion has arisen, owing to the Mineral Lands Commissioner having given in 1885 the amount of ore *raised*, while in 1886 only the amount *smelted* is given. Probably the amount smelted in the latter year included some of that raised in the former, so that the Returns are defective for statistical purposes. The following Notes embody all the information obtainable:—In 1885, 2,028 tons of ore were *raised*, containing 218,450oz. of silver. Estimating the value of the ore on a basis of 3s. 6d. per oz. of silver, the value would be £38,229. In 1886, 1,440½ tons of ore *smelted*, yielded 223 tons of Bullion, estimated to contain 88,224oz. of silver; at 3s. 6d. per oz. of silver, the value would be £15,439. How much was *raised* during the year is not stated. In 1887, 1,041 tons of ore were raised, at a value estimated at £54,572. The amount of Bullion for the year is not given, at least in the Abstract of the Annual Report accessible to me up to date. For the quarter ending 31st March, 1888, a Newspaper Report gives the Mineral Lands Commissioner's Return of 1,262 tons of ore smelted, for a yield of 250 tons Bullion, estimated to contain 54,250oz. of silver; at 3s. 6d. per oz. this would be worth £9,494. These total values, for obvious reasons, cannot be added together.

Yield of Mount Albion Silverfield.

1885.—Mineral Lands Commissioner's Report:—"Discovery of Chlorides in Albion early in year; 528 tons raised—87 tons

shipped to London, estimated to contain per assays 25,450oz; remaining 441 tons estimated to contain 66,000oz. silver." Several other lodes, chiefly galena, are being worked by the same proprietary, and have yielded 1,500 tons of ore, estimated to contain over 127,000 oz. of silver. Preparations for the erection of a Water-jacket smelter are being actively proceeded with."

Abstract.

Ore raised from Mount Albion,		87 tons,	containing		25,450oz.
Do	do	do	441 do	do	66,000oz.
Do	do	galena lodes,	1,500 do	do	127,000oz.
			2,028 do	do	218,450oz.

Value, at 3s. 6d. per oz., £38,229.

1886.—Mineral Lands Commissioner's Report:—"The two smelters have been in almost constant work since their erection, and 1,440½ tons of galena and other silver ores have been reduced for a yield of 223 tons of lead bullion, estimated to contain 88,224oz. of silver. A very large quantity of ore is stacked at the Mount Albion shaft, and quantities of ore containing Chloride of silver are being raised from the Lady Jane Shaft, on the same property."

Silver Contents of Bullion, 88,224oz., at 3s. 6d. per oz., £15,439.

1887.—Annual Report of Department of Mines:—"1,041 tons Ore raised (amount smelted not given). Value, £54,572.

Quarter ending 31st March, 1888:—1,262 tons smelted; yield of Bullion, 250 tons; Contents, 54,250oz. silver, at 3s. 6d. per oz., £9,494.

Dry River Silver Field.

This field lies in the belt of mineralised stratified rocks which extends South-Eastward from Mount Albion. The slates and grey-wackes which form the mass of the strata strike mainly North and South. The principal lodes—the Try-no-More, Dunn's, Silver Streak, Target, Silver Valley, White Star, and Rainbow—trend on an average from North-West to South-East, and underlie to the South-West. They have, as a rule, caps of ferruginous gossan showing lead oxide, galena, sulphate of lead, and Carbonate of copper. In the Try-no-More, the ore at a greater depth is somewhat complex, being composed of copper pyrites, grey iron pyrites, galena, and zinc-blende. The other mines, however, yield chiefly argentiferous galena, with occasional zinc-blende. A smelting Company commenced operations in 1883, and suspended operations in 1886. There is no doubt that several of the mines are distinctly payable. The failure of the field is attributed locally to the policy of the Smelting Company, which was said to have been to force outside holders to sell their mines. The result is said to have been that ultimately these mines ceased to produce enough to keep the Works employed. A decidedly good opening is offered by this field for a smelting work conducted on a more rational principle.

At present operations on the field are limited to the raising of limestone and ironstone, used as fluxes at the Mount Albion Works.

The following table gives extracts from the Mineral Lands Commissioner's Reports :—

YIELD OF DRY RIVER SILVERFIELD.

1883.—100 tons Ore smelted yielded $18\frac{1}{2}$ tons bullion, valued at £832.
1884.—200 tons Ore raised, valued at £1,600.
1885.—500 tons Ore raised, and dressed for smelting; estimated silver contents, 30,000oz.; estimated value, £5,844.
("The Pacific Smelter had a trial run, and smelted 120 tons of ore for a yield of 42 tons of Bullion, valued at £40 per ton; but smelting has again been suspended.")
1886.—420 tons Ore smelted yielded 117 tons Bullion; Estimated silver contents, 22,230oz.; Estimated Value, £4,668.
("But at present smelting operations are suspended.")

Ravenswood Silver Field.

A belt of argentiferous rocks extends for about six miles North-Westward from the richest part of the Ravenswood Goldfield. Although the goldfield and the silverfield are both in granite country, a tolerably distinct line may be drawn between the grey syenitic granite of the goldfield and the coarse-grained red granite of the silverfield. The latter is a mixture of roundish blebs of quartz, flesh-coloured or pinkish orthoclase crystals, and hexagonal mica. The principal lode, known as King's, or the "One-mile," runs North 28degs. West, and underlies at 35degs. to East 28degs. North. It is a very rich lode, and frequently consists of two parallel veins. The surface yielded carbonates of lead, giving as much as 300oz. of silver to the ton. The lower levels have given a steady yield of galena ores, with, as a rule, 2oz. of silver per ton to the unit of lead. The galena is in places a good deal mixed with pyrites and zinc-blende. In a shaft in Lease 109 the lode has been cut at a vertical depth of 650 feet. The shaft bottomed on an antimony and copper ore, somewhat resembling Tetrahedrite in its composition, but containing from 500oz. to 5,000oz. of silver to the ton. Pumping and winding and dressing machinery are being erected to work this rich deposit.

The Mount Right lodes, at the North-Western end of the argentiferous belt, have not yet been worked on a large scale, although the Warden reported that in 1883 a single miner raised 20 tons of galena ore, worth £400. In 1884 the same "hatter" raised 26 tons, worth £702. Some thin lodes of antimony ore occur among the silver-lead mines of Mount Right.

In the following table, the great bulk of the ore has been raised from King's Mine. The other mines are specified where the information is given in the Annual Reports of the Department of Mines.

YIELD OF RAVENSWOOD SILVER FIELD.

Year.	Mine.	Tons of Ore.	Raised, Exported or Dressed.	Value. £ s. d.
1880	43 Mount Right	12½	Exported	371 5 0
,,	44 ,,	2½	,,	86 1 3
,,	One-mile (King's ?)	108	,,	3,152 10 0
1881	King's	357	,,	14,040 0 0
,,	Roberts and Others	20	,,	1,400 0 0
1882	—	200½	,,	6,762 0 0
1883	—	381	,,	12,072 0 0
1884	—	895	,,	20,560 0 0
1885	—	905	,,	22,937 0 0
1886	—	928	Dressed	23,114 0 0
1887	—	1,142	Raised	25,520 0 0
		4,945½		130,014 16 3

Argentine Silver Field.

The argentiferous lead lodes of the Argentine field occur partly in granite country and partly among highly-inclined micaceous clay-slates, mica schists, and gneisses. Regarding the age of the sedimentary rocks above referred to, no distinct evidence has yet been brought to light. A thick series of white sandstones, pebbly grits, and conglomerates, probably identical with the lower portion of the "Star Beds" (Upper Carboniferous), lies unconformably on the slates, &c., or rests on the Granite.

The field has been in existence since 1881. The lodes, especially those in the mica schist country, offer every indication of richness and permanence; fuel and limestone and ironstone for fluxing are abundant and conveniently situated. In spite of all these advantages, prosperity has hardly yet dawned on the field. The majority of the lodes were originally secured as freeholds under the old Mineral Lands Act, the workings being for a time of a very perfunctory nature and having for their object the bare fulfilment of the "improvement conditions," or the raising of sufficient "specimens" to induce outsiders to purchase the mines. Some of the mines, worked on a "poor man's" scale, have obviously failed through the mechanical difficulty of separating earthy low-grade oxide and carbonate ores from the almost equally heavy ferruginous gangue-stuff without dressing machinery. The failure of the Smelting Works, which were erected prematurely, before sufficient quantities of ore were ready for them, was a severe blow, destroying as it did confidence in the value of the mines, and bringing about their almost complete desertion. The Hero and Northbrook Mines have, however, been steadily worked at a profit for some years, the ores being shipped

from Townsville. A powerful Company has now secured the former, and it is reported that their operations have been highly successful.

The surface ores, which have alone been raised hitherto, consist for the most part of oxides, carbonates, sulphates, and sulphides of lead. The silver-contents of samples which I have assayed average generally about $1\frac{1}{4}$oz. per ton to the unit of lead, but occasionally reach 5oz. of silver to the unit. In other words, a ton of galena ore containing 60 per cent. of lead might contain from 75oz. to 300oz. of silver. There can be no doubt that this field will yet take a high place among the silver-producing localities of Australia.

As the Argentine field was only occasionally visited by the Warden from Ravenswood, the Returns of the output as given in the Annual Reports of the Department of Mines only give occasional references to quantities of ore exported. The following are all the particulars obtainable from this source:—

1883.—10 tons exported;	value	£20
1884.—20 " "	"	225
1885.—20 " "	"	600
50 tons		£845

Three exporters of Ore have supplied me with the following returns of ore which passed through their hands:—

Date.	Exporters.	Quantity of Ore.				Value at the Mines.			Assay.		
									Ld.	Silver.	Gold.
		Tons.	Cwt.	Qrs	Lbs.	£	s.	d.	Per cent	Oz. per ton.	Oz. per ton.
May, 1883.	L. Ryan.	3	10	0	0	165	0	0	—	—	—
May, 1887.	"	1	0	0	0	55	0	0	—	—	—
Jan. 1, 1884 to Jan. 1, 1888	Hays & Bundock.	200	0	0	0	1,600	0	0	—	—	—
1885 June.	Allen & Sons.*	3	3	0	0	39	8	0	—	101·26	0·327
" July.	"	3	15	0	0	46	0	0	—	98·	0·327
" Aug.	"	6	14	2	26	31	0	0	30	60·43	1·47
1886 June.	"	9	15	0	0	153	0	0	43	84·	—
1887 May.	"	3	5	1	16	29	0	0	43	85·	—
" June.	"	3	1	0	16	17	16	0	33	64·	—
" July.	"	6	5	2	8	27	16	0	20	57·	—
" Aug.	"	4	1	0	0	21	16	0	64	27·	—
" Dec.	"	5	10	0	0	8	4	3	21	41·	—
1888 Jan.	"	3	6	1	0	12	11	4	22	53·	—
Totals	—	298	17	0	10	2,206	11	7	—	—	—

* Messrs. Allen & Sons' Returns give the amount received for the ore in England, less £1 per ton for freight. From these I have deducted £4 per ton for carriage to port and other expenses.

Another mode of estimating the value of the Argentine Ores is furnished by the following Return, kindly supplied by Mr. Joseph Hughes, Sub-Collector of Customs, Townsville. If from the totals of 7,064 tons 16cwt. 3qrs., shipped at Townsville from 1883 to 1887 inclusive, and valued at £159,893, we deduct 4,251 tons from Ravenswood, valued at £104,203, and 667 tons from the Sellheim, valued at £13,115,* in all 4,928 tons, valued at £117,318, we obtain (provided the Ravenswood and Sellheim Returns are complete) 2,136 tons 16cwt. 3qrs., valued at £42,575, as the product of the Argentine field. But that this is an over-estimate is as certain as that the results obtained by the other methods are under-estimates.

Return showing the Quantity and Value of Silver Ore exported from the Port of Townsville during the years 1883, 1884, 1885, 1886 and 1887—

Year.	Tons.	Cwt.	Qrs.	Value.
1883	1,197	15	0	£37,576
1884	882	13	0	22,886
1885	2,227	8	3	38,867
1886	1,594	18	0	33,807
1887	1,162	2	0	26,757
Totals	7,064	16	3	£159,893

Sellheim Silver Field.

This field furnishes good argentiferous galena ores, and, although it has been worked under considerable difficulties, owing to its distance from the coast and the absence of dressing or smelting works, has, with energy and perseverance, been able to hold its ground. It is probable that smelting works will shortly be erected. The principal lodes are the Pyramid, Bonnie Dundee, Birthday Gift, General Gordon, Sunrise, and Argentine. Carbonate of Bismuth has recently been found in one of the silver lodes. The mines appear to be situated in "a series of blue and grey slates and shales, on the upturned edges of which rest the slightly-inclined grits and sandstones of the Upper Devonian *Lepidodendron* beds." Fossils from the slates and shales were referred by Professor McCoy to the Upper Silurian period. ("General Report upon the Northern Division," by Richard Daintree, p. 7. Brisbane: By authority, 1870.)

* Figures taken from the Annual Reports of the Department of Mines.

YIELD OF SELLHEIM SILVER MINES.

Year.	Ore Exported.	Value.
	Tons.	£
1883	20	400
1884	120	2,400
1885	278	5,165
1886	259	5,150
Totals ...	677	£13,115

(The returns for 1887 have not yet come to hand.)

TIN FIELDS.

Pascoe Tinfield.

Stream tin has recently been discovered near the mouth of the Pascoe, but the value of the discovery has yet to be tested. The tin ore probably came from the granite country of the Carron and Janet Ranges.

Cannibal Creek Tinfield.

Up to 31st December, 1884, 2,373 tons of Tin Ore, valued at £102,300 10s., had been exported from the Palmer Goldfield, chiefly from alluvial workings on Granite and Cannibal Creeks. Although this stream tin was collected from slate and greywacke country, and in the neighbourhood of the Cannibal Creek lodes, it probably came, for the most part, from the granite range to the East. This range, which is a stronghold of the aborigines, has never been sufficiently prospected for lodes. The lodes on Cannibal Creek are large quartz reefs, running East 15deg. South, and containing some tin ore. The formation of a Company to work these lodes resulted disastrously, as expensive machinery was erected before the mines were proved to be payable.

YIELD OF PALMER TINFIELD.

(Prior to) 1880.*	450 tons;	estimated value,	£22,500 0s.
1880.	759 ,,	,, ,,	38,000 0s.
1881.†	535 ,,	,, ,,	16,847 10s.
1882.	360 ,,	,, ,,	11,340 0s.
1883.‡	199 ,,	,, ,,	10,119 0s.
1884.	70 ,,	,, ,,	3,556 0s.
Totals ...	2,373 tons		£102,300 10s.

* Exported by Whitehead & Co.
† Including, for the first time, Cannibal Creek lode tin.
‡ Cannibal Creek Company wound up.

Annan and Bloomfield Tinfields.

These tinfields have only recently been opened, and as yet, or till very recently, the only ore exported has been stream tin, which is found in narrow gullies among tropical jungle. The country-rock is granite. Fortunately water is abundant, and washing presents no difficulties. The narrowness of the gullies hitherto worked has made it not worth while to apply hydraulic power to the washing, but this will probably be done in future in the wider and deeper drifts of the lower reaches of the Annan, Trevethan Creek, and the Bloomfield. In the Mount Amos district, several lodes or reefs of quartz, containing tourmaline, hornblende, wolfram, and tin, have been opened. Very extensive deposits of lode tin have lately been discovered at the Lion's Den and Mount Leswell, and dressing machinery is about to be erected. The following table shows the export of stream tin from 1885 to the end of March, 1888:—

YIELD OF ANNAN AND BLOOMFIELD TINFIELDS.

1885	300 tons ...	Value,	£3,144.
1886	148 " ...	"	£7,400.
1887	944 " ...	"	£58,783.
To 31st March, 1888	295 " ...	"	£22,140.
Total	1,687 tons.	Value,	£91,467.

Herberton Tin Field.

This field, which is by far the most important source of lode tin in Australia, is still in its infancy, having only been discovered in 1879.

The "Country rock" of this field is divisible into three classes: (1) a perfectly normal Granite; (2) a Porphyry of Quartz and felspar (quartz predominating), with mica as an occasional or accidental and not essential constituent; and (3) highly inclined greywackes, quartzites, and shales. The rocks of the first class, which extend Northward from Watsonville, appear to be nearly barren of tin ore. Those of the second were for a time regarded as the only seat of the tin deposits; but it is now questionable whether those of the third class do not excel them in this respect.

The Porphyry Rocks are intersected in every direction by large "elvan" dykes (compact, highly-silicated yellowish or greenish felspar base with blebs of quartz). These elvans contain a good deal of arsenical pyrites, but—except in the case of the "Three Star" Mine—have not yet proved to be tin-bearing to any great extent. Dykes of quartzose chlorite and quartzose serpentine—probably originally intruded among the porphyry as quartz-diorites, or as rocks more or less of basaltic type, and subsequently metamorphosed—form the chief matrix of the tin ore in the porphyry country. The

ore occurs in floors, veins, or pipes among the joint-planes of the dykes. The ore (binoxide of tin) is rarely crystalline; but occurs either in amorphous masses, almost chemically pure, or intermixed with the dyke rock. Sometimes, as in the Bradlaugh Mine, the ore is so finely disseminated through the dark chlorite matrix as not to be distinguishable by the naked eye. These "chlorite ores" generally weather of the colour characteristic of iron peroxide, and in such cases the tin ore is rather more obvious. Fluor spar and Wolfram are associated with the ore, but tourmaline is of rather rare occurrence.

It seems most probable that the tin first came up in solution after the consolidation of the dykes and has been deposited along their walls and among the fissures and joint-planes which traversed them. A re-solution of the tin ore probably took place simultaneously with the metamorphism of the dykes; and as the metamorphosed dykes had probably a new joint system developed in them, a further concentration of the ore may have taken place.

Considerable difficulties were at first experienced in following down the apparently capricious ore deposits, and the miners were haunted by doubts as to their continuance at greater depths. It has always seemed to me that their intimate connection with dykes was a sufficient guarantee of their great vertical range. The Great Northern, which has maintained from the beginning its position as the leading mine in the Porphyry country, is now turning out ore from the 300ft. level.

In the Sedimentary Country Rock the Group of mines now united in the North Australian Lease, near Watsonville, was the first to attract attention. In these mines, especially in the North Australian and Ironclad, the lodes, although themselves sometimes poor for a distance, sent off huge "carbonas" of tin and copper ore along the bedding-planes of the shales and greywackes. In 1883-6, this group of mines yielded 1,287½ tons of dressed tin ore, valued at £64,382.

More recently very important lodes of tin ore have been opened up in the sedimentary rocks at Irvinebank (Great Southern, &c.), in Glen Linedale, and at Denny & Dogherty's Camp. In the Irvinebank lodes the ore is generally of the "chlorite" type, and in the Great Southern mine it is associated with arsenical pyrites, bismuth, stibnite, &c. In the Gordon, in Glen Linedale, the ore impregnates a country-rock of hard, fine-grained, siliceous, and talcose sandstone. At Denny & Dogherty's Camp very fine crystals of tin ore are disseminated through a chloritic matrix in lodes which coincide with the bedding of the country-rock (pebbly grits).

There is little doubt that the stanniferous sedimentary rocks of this district are part of the same mineralised belt which has produced the lead and silver ores of Mount Albion and the Dry River.

Yield of Herberton Tinfield.

Year.	Lode Tin Ore.		Stream Tin Ore.	Total.	Value.	Remarks.
	Stone Crushed.	Yield of Black Tin.				
	Tons.	Tons.	Tons.	Tons. cwt.	£	
*1879	...	...	...	131 9	5,260	Exported.
*1880	...	...	...	193 11	7,740	”
*1881	...	...	...	1,183 10	47,340	”
*1882	...	...	...	1,810 2	72,400	”
†1883	12,405	2,646	...	3,346 0	109,740	Raised.
†1883	"Bagging Ore"	100	...		...	”
†1883	...	...	600	...	25,200	”
†1884	11,031	1,902	...	2,352 0	68,474	”
†1884	...	...	450		16,200	”
†1885	12,834	2,096	250	2,346 0	117,787	Raised; 651 tons black tin smelted at Irvinebank yielded 438 tons tin.
†1886	14,811	2,198	...	...	109,920	Raised; 666½ tons black tin smelted at Irvinebank yielded 416½ tons tin.
†1886	...	...	250	2,448 0	13,000	
†1887	...	1,508	...	1,508 0	126,560	Raised.
‡Quarter ending Mar. 31, 1888	2,775	462	35	497 0	41,748	”
Totals	...	...	...	15,815 12	761,369	

Mount Spurgeon Tinfield.

This field has only been discovered in 1886. Lodes are known to exist, but the only export as yet has been stream tin ore. The Report of the Department of Mines, for 1887, gives the amount of ore raised as 60 tons, valued at £4,800. According to the Agent for the A.U.S.N. Co., at Port Douglas, the amount of Mount Spurgeon tin ore exported from the opening of the field up to 28th April last was 200 tons. At £80 per ton, which is the value put on the ore raised in 1886, the 200 tons would be worth £16,000.

Kangaroo Hills and Running Creek Tinfields.

Stream tin ore has been worked on Running Creek as far back as 1875, but no records of the output are now obtainable. The country-rock is porphyry. Garnets and topazes are found in the wash.

* From Return to the Legislative Assembly of Tin Ore exported from Tinaroo District, 1886.

† From Mineral Lands Commissioner's Report in Annual Reports of the Department of Mines.

‡ From Newspaper Report.

YIELD OF RUNNING CREEK TIN MINES FROM 1883.

1883 ...	... 25 tons of stream tin; value ...	£1,000.
1884 ...	... 27 " "	1,134
1885 ...	... 5 " "	225
1886 ...	... 6 " "	330
	Total	£2,689

The discovery of stream and lode tin ore in Kangaroo Hills resulted from the impetus given to prospecting by the opening of Herberton. The country-rock is porphyry, very like that of Herberton. Although the lodes promise well, a difficulty has hitherto been experienced in the introduction of capital to work them, and the sole export as yet (with trifling exceptions) has been stream tin ore. In 1883, Mr. Warden Pears reported: "In the Prospectors' Selections the lode has been opened in several places, and shows splendid tin, and a very regular formation for so shallow a depth. Bismuth has been found, and there are also copper lodes."

YIELD OF KANGAROO HILLS TINFIELD.

1885 ...	... 100 tons of stream tin raised; value...	£5,556
1886 ...	... 121 " " " " ...	6,534
1887 ...	... 98 " " " " ...	4,334
Totals	... 319	£16,424

Stanthorpe Tinfield.

The Stanthorpe Stream Tin Mines, on the borders of New South Wales, lie on the surface of a granitic tableland, at an average elevation of a little less than 3,000 feet above the sea. The heads of the streams are shallow and swampy. Where the streams attain any magnitude they find it easy to wander among the soft decomposing surface of the granite country. The Severn, therefore, and its tributaries, such as Quartpot Creek, have exceedingly tortuous courses and deep alluvial deposits.

By far the greater part of the stream tin is in fine grains of the size of a pin's head and under, and almost always reveals under the lens some trace of an original crystalline condition. It contains a large proportion of the "Ruby" and "Amber" varieties. Together with quartz granules it forms, as a general rule, the matrix of a coarse imperfectly cemented conglomerate or gravel of quartz and granite pebbles. The pebbles are often rather squared than rounded. They are not of a nature to retain striations well, but the shape of some of them leads me strongly to suspect that their attrition might, in the first instance, have been due to glacial action. The crystalline fragments of felspar, which have frequently been carried into the wash along with the quartz and tinstone, have in most cases decomposed into a stiff kaolin, which sometimes helps to keep the wash together.

The tin wash is for the most part confined to the layer of gravel or unconsolidated conglomerate lying directly on the bed-rock. This gravel is generally overlaid by a varying thickness (up to 25 feet or more) of gritty sand, which is occasionally interrupted by thin layers of gravel (with streaks of tinstone) or of clay.

After an examination of the alluvial workings (in 1882), I concluded that the tinstone, in its original matrix, must have been in the form of crystals, rarely of large size. The ore was probably *concentrated* by the weathering of its matrix—whether reef, lode, or dyke—and of the encasing granite country during a long period of gentle subaërial denudation, when the rains were never sufficiently heavy to remove the tin, or even the larger quartz stones, from the hillsides where they were left by the decay of their matrix. To this there apparently succeeded a limited period of heavy rainfall, or possibly of snow whose melting produced a rush of water sufficiently strong to "sluice" the general surface of the hill country, and to deposit its heavier materials (including the tinstone) in the upper reaches of the Severn and its tributaries, while carrying off its finer particles to the plains of the South-West. To the now current period belong the accumulation under temperate conditions of the existing surface wash on the hillsides (moderately rich in Tin ore), and the deposition of the sand (almost destitute of tin ore) which overlies the tin-wash in the streams.

Two distinct types of tin-bearing rocks are met with in the district—quartz reefs and igneous dykes.

The reefs are best developed in the Ridges on the left bank of Quartpot Creek, nearly opposite Sommerville's homestead. Here are the outcrops of at least seven reefs or veins, four of which bear North-North-East, one North-East, and one East and West.

They are of highly crystalline quartz (sometimes smokey), and all contain much wolfram and moderate-sized crystals of tin ore, the latter almost always confined to faces and joints. Such reefs are apparently the sources of some of the coarser stream tin which is locally met with.

The dykes are composed of granular quartz, fine scaly lithia-mica, and small crystals of tinstone, and form a rock much resembling the stanniferous Greisen of Saxony. They seem to have been erupted in a molten condition (bringing up the tin oxide with them), among fissures in the granite. The tinstone bears, in some samples I have seen, a proportion of 5 or 10 per cent. to the general mass of the rock. Dykes of this character are seen at various points in the range on the boundary of the colony, between the heads of Kettle Swamp and Sugarloaf Creeks. They run at varying angles from North-North-East to East-North-East, coinciding in their direction with a system of jointing, which characterises the granite. The tin ore crystals of the dykes are precisely what, with a little attrition, would form the main mass of the stream tin of the heads of the Severn.

In spite of the riches of the alluvial deposits of Stanthorpe, no payable tin lode has yet been found on the Queensland side of the border.

The Stanthorpe Tinfield has never been geologically mapped in detail, but the exhaustive Report of Mr. T. W. Edgeworth David on the Vegetable Creek Tin Mining District of New South Wales, throws considerable light on the subject. Mr. David classifies the stanniferous deposits as follows:—

Deposits of Tin Ore.

- Alluvial Stream Works.
  - Recent and Pleistocene "Shallow Leads."
  - Tertiary "Deep Leads," mostly capped by lava.
- Plutonic Veins.

YIELD OF STANTHORPE TINFIELD.

Source	Year.		Tons of stream Tin Ore raised.	Value £.
1885. Dept. Report.	1872	...	1,407	£109,816
	1873	...	8,938	606,184
	1874	...	5,702	358,550
	1875	...	4,475	237,879
	1876	...	4,315	187,201
	1877	...	3,335	133,432
	1878	...	2,849	88,366
1885.—Dept. Report and Return to Mr. Macrossan, 1886.	1879	Total in Queensland 2,877 tons, value £120,391; less Herberton 131½ tons, value £5,260.	2,745½	115,131
	1880	Total in Queensland 2,847 tons, value £142,977; less Herberton 193½ tons, value £7,740.	2,653½	135,237
	1881	Total in Queensland 3,456 tons, value £193,699; less Herberton 1,183½ tons, value £47,340.	2,272½	146,359
	1882	Total in Queensland 4,261 tons, value £269,904; less Herberton 1,810 tons, value £72,400.	2,451	197,504
	1883	...	817	40,233
	1884	...	934	41,096
	1885	...	503	25,150
	1886	...	430	24,940
	1887	...	356	22,072
			44,183½	£2,469,150

COPPER FIELDS.

Cloncurry Copperfield.

(*See* CLONCURRY GOLD AND COPPER FIELDS.)

Peak Downs Copperfield.

"This lode was discovered in 1862. It can be traced for over $1\frac{1}{2}$ miles, running in an East and West direction. It has an underlie varying from 40 to 70 degrees to the South. The country consists of foliated and contorted micaceous and hornblendic schists, dipping South-East. The outcrop is a gossan, consisting chiefly of red and brown hæmatite, with a little oxide of manganese, and carbonates of copper. The ores were oxides and carbonates of copper to a depth of about 75ft. vertical from the surface, a mixture of oxidised ores and sulphurets to a depth of 120ft., and below that depth they were ordinary sulphurets of Copper.

"The gossan at the surface was auriferous; assays of it give from 4dwt. to 1oz. 15dwt. of gold per ton, and also up to as high as 5oz. of silver per ton.

"The deepest workings were 66 fathoms. Most of the lode was taken out to a depth of 40 fathoms for a distance of half-a-mile. From 1862 to 1878, when the original company was wound up, about 100,000 tons of Ore, averaging 17 per cent. of Copper, were smelted at the company's own works. That would give 17,000 tons of Copper, the value of which was over £1,250,000. Copper lodes, known as the "Western Peak Downs Copper Lodes," exist about 7 miles West of Copperfield. Rich sulphurets of copper were obtained from these." (Rands's "Geology, &c., of Clermont.")

Mount Perry Copper Mine.

Although this is not the only Copper Mine in the district, it is the only one which has been worked continuously and on a large scale. Its output for the last 12 years is given by Mr. Israel Bennett, the manager, as:—

95 tons ore at £20 ...	... ...	£1,900 0s.
$19\frac{3}{4}$ " £10 ...	... ...	191 10s.
1200 tons copper at £70	... ...	84,000 0s.
Total	... ...	£86,091 10s.

"Seven shafts have been put down on the lode to various depths; the main or engine shaft is now between 800 and 900ft. deep. The course of the lode is North, 37 degrees East, and where it is at present being worked (to the South-West of the main shaft) it heads to the South-East about 8 degrees" [from the vertical]. "Near the surface the ore consisted of green Carbonate and Azurite, and at 30ft. deep of

rich red (Cuprite) and grey oxides of copper, and below this depth of yellow ore and copper pyrites. The pyrites is contained in a veinstone of quartz and calcite, each of which predominates in turns. To the North of the main shaft much iron pyrites has been met with mixed with the copper ore. At the present depth [1885] the lode is about 4ft. in width. The width of ore is about 10in. on an average." . . . "There are numerous cross-courses, which, although they do not displace the lode, yet often affect the ore in the lode, either by breaking it up into strings, or by displacing it from one side of the lode to the other. At these points of intersection the lode is usually enriched. A dyke of orthoclase porphyry runs parallel with the lode, and is displaced too by the cross-courses. Two dykes of dolerite also cross the lode in a North-Westerly direction." The country-rock is a syentic granite which Mr. Rands regards as Metamorphic. The granite in places has carbonate of copper diseminated through its mass. At the "Queensland" Claim, the granite is worked as a low-percentage ore (10 per cent. of copper) to assist in the smelting of the Pyrites at the Mount Perry Mine.

The Canterbury and Normanby lodes adjoin and run parallel with the Mount Perry lode. Nine miles to the West is the Potosi lode. It contains galena, with copper and iron-pyrites and a little zinc-blende, in a gangue of quartz and barytes. The Mungai lodes are 3 miles further West, in a country-rock of actinolite schist. From these lodes carbonates of copper are raised for smelting with the Mount Perry ores.

The Wolca lodes are 6 miles North of Mount Perry. Some of these contain gold, one (the Allendale) as much as 15dwts. to the ton, as well as copper ore. There is another group of lodes in the paddock of Wombah Station.

The Boolboonda Mines lie to the East of the granite country, in a belt of metamorphic rocks, consisting of gneisses, schists, quartzites, &c. The "Boolboonda," "Cambria," and "New Moonta" lodes, contain gold as well as copper—apparently in several cases in proportions, which would be payable under favourable conditions. (For further details see Mr. Rands's "Report on the Goldfields of Raglan, &c., and the Mineral Deposits in the Burnett District." Brisbane: By Authority, 1885.)

MERCURY MINES.

Kilkivan Mercury Mines and Mount Coora Cobalt Mine.

Mr. Rands reported as follows on the Queensland and Wolf Cinnabar Lodes in the end of 1886:—

"The matrix of the lodes consists of quartz and calcite. Both lodes are looking well, showing Cinnabar all through the stone.

"At the Queensland Lode the shaft is down 42ft. The Lode runs North and South. At the bottom of the shaft the lode is divided into two parts by a "horse" of mullock. On the eastern or footwall is a small vein of quartz which is very rich in ore; next to this is about 8in. of quartz and calcite, with ore throughout it; while on the hanging wall is another mass of vein-stuff containing cinnabar. A little to the North of the shaft the lode takes a sharp bend to the West. The country is an altered conglomerate or agglomerate, probably of Volcanic origin, as it is full of angular particles

"On the Wolf Lode a level has been driven on the bank of the Gully for 170ft. on the lode. The country for the first 100ft. or so consists of sandstone and shale dipping South-West at this point, and above them is a volcanic ash, much decomposed, and containing often large angular pebbles. The lode runs North-East, and averages about 1ft. in thickness. The matrix contains much more calcite than that of the Queensland lode.

"A cross-cut lower down the gully cuts several lodes or veins. At 19ft., one of 1ft. in thickness, of calcite; at 55ft., a lode of 1ft. 2in. wide, showing good ore; at 119ft. is a vein of calcite, which appears to be dipping towards some leaders at 145ft., which contains cinnabar; and at 200ft. the Wolf is cut 4ft. 2in. wide, and contains a very good percentage of Cinnabar.

"Very rich pieces of nearly pure Cinnabar have been picked up in a gully on this claim, supposed to have come from a small vein a short distance from the Wolf Claim.

"So far as the work has at present gone, the prospect for the future of these mines looks very encouraging." (Report of the Department of Mines for 1886.)

An influential Company with a large capital has recently been formed in London to work these mines. Mr. Clement Tancred reported to the Directors that the Queensland Lode might be guessed to "run for 7ft. wide at something between $2\frac{1}{2}$ and 3 per cent., without any dressing." The "Sligo" lode, according to Mr. Tancred, "has only been prospected a few feet in depth, not sufficient to get into settled country. Mr. Hester treated 100lb. of ore from here, and obtained 70lb. of Quicksilver." The "Wolf" ore "will give, Mr. Hester tells me, an average of fully 6 per cent. all over." The "Hill Lode," on the "Wolf," is said to be "outcropping for a distance of 1,000ft. on the surface, and is metal-bearing throughout."

Nothing is recorded of the output of the Cinnabar Mines. In 1877, the Warden reported that "considerable progress has been made by the Messrs. Hester at their Cinnabar Works. They have for some time past kept the machines at Gympie fully supplied with quicksilver. The quicksilver supplied by Hester Brothers is preferred by the amalgamators at Gympie to the best article of its kind imported."

Several other Cinnabar lodes occur in the district on the heads of Wide Bay Creek.

A **Cobalt Lode** occurs in a spur of Mount Coora, consisting of Serpentine. The lode has been traced over half-a-mile North and South, and underlies to the West at about 50 degrees. "At its outcrop the lode consists of 10 or 12ft. of a talcose casing, with Cobalt ore throughout it next to the footwall; then 22ft. of Cobalt ore with a brown siliceous matrix (this forms the Chief ore-bearing portion of the lode); above this again, next to the hanging-wall, is a mineral similar to pimelite, consisting of silicates of magnesia and alumina with a little silicate of nickel. A tunnel 80ft. in length has been put in on the back of the lode, and from the end of the tunnel a cross-cut has been driven through the lode, which passed through 15ft. of the main portion or Cobalt-bearing part of the lode, and then about 10ft. of the casing seen at the surface; beyond this another mass of cobalt ore occurs, the width of which has not yet been ascertained. The ore is that known as earthy cobalt, consisting of oxides of cobalt, manganese, iron, and a little copper.

"Assays have shown the average ore to contain about 6 per cent. of cobalt, which, according to last Sydney quotations, is worth about £13 10s. per ton. By hand-picking the ore it might be brought up to about 10 per cent., which would be worth £23 per ton. The extent of the lode, and the large body of ore it contains, makes this undoubtedly a very valuable and important discovery." (Mr. Rands, in Report of the Department of Mines for 1886.)

ANTIMONY MINES.

Northcote Antimony Mines.

The three principal antimony lodes, viz., the "Emily," "Craigs," and "Matilda," occur within the limits of the Hodgkinson Goldfield, nearly in a line running North-West from the head of Leadingham Creek to the head of the Hodgkinson. This line coincides with the strike of the slate and greywacke country-rock, and with the trend of the lodes. The lodes, however, underlie to the South-West, while the strata dip to the North-East. They are traceable for considerable distances on the surface, as quartz reefs stained with antimony oxide, and on being opened show large shoots of solid sulphide of antimony (Stibnite). The "Emily" was worked for some time for gold; the recorded crushings, 382 tons 12cwt., having yielded 315oz. 13dwts.

The Wardens' Reports mention that in 1877 several tons had been prepared for shipment, but as the price in Melbourne was only £12, nothing further had been done; that in 1881, Messrs. Denny & Co. were erecting Smelting Works; that in 1882, a quantity of ore had been raised; that in 1883, Messrs. Edwin Field & Son had erected

large Smelting Works; that in 1884, 550 tons of ore had been smelted, yielding 145 tons of crude antimony, valued at £3,500, and that the Company had suspended operations; and that in 1885, 70 tons of ore, valued at £300, had been raised.

Antimony lodes also occur down the Hodgkinson at Woodville.

Ravenswood Antimony Mines.

(*See* RAVENSWOOD SILVERFIELD.)

Neerdie Antimony Mine.

The history of this mine, which, apparently, is rich in Sulphide of Antimony, has been varied by periods of prosperity and depression according to the rise or fall in the price of the metal. The total amount of ore produced from 1873 to 1886 was 930 tons, valued at £11,769. The statistics, however, give the amount of ore *raised* except in the year 1881, when only the amount *shipped* is given.

YIELD OF NEERDIE ANTIMONY MINE.

Year.	Tons of Ore.	Value.
		£
1873	15	157
1874	207	2,141
1875	60	360
1876	18	216
1877	101	606
1878	27	405
1879	4	40
1880	Nil	...
1881	163	1,965
1882	no return.	...
1883	127	2,550
1884	198	2,969
1885	no return.	...
1886	110	400
Totals	1,030	£11,809

COAL FIELDS.

Burrum Coalfield.

The Burrum Coalfield extends from the mouth of the Kolan River to Noosa Head, but it is only at the township of Howard that collieries have as yet been opened. It occurs in a very flat country, and prospecting operations are for the most part reduced to mere "blind-stabbing" by the fact that the coal seams rarely come to the surface, the whole of the flat being covered unconformably by a more recent horizontal deposit of sandstone, clay or loam, from 15 to 50ft.

in thickness. The Coalfield itself appears to be intermediate in age between the Bowen River Beds (Carbonifero-Permian) and the Ipswich Beds (Jurassic), from the intermingling of fossil plants common to both of these formations. The fossil fauna is meagre, and as several of the species are peculiar to the Burrum Beds, they are of no value for stratigraphical purposes. The Beds of the Coal Measures "extend from the coast some 20 miles inland, to near the heads of the Burrum and Isis Rivers, where, dipping at a high angle, they are altered into a series of micaceous schists, and finally rest upon granite."

The principal Coal seams, in descending order, are:—

	Ft.	in.
Bridge Seam.—Coal	2	7
Shale	5	0
Coal	3	0
Shales with three thin Coal Seams ...	220	0
Lapham or Torbanelea Seam—2ft. to 6ft. 2in. including a "band" of 15in. ...	4	11
Shales	35	0
Burrum Seam	3	7
Shales, Sandstones, and a 7in. Coal Seam	150	0
Watson's Seam	4	0
Shales, Sandstones, and two thin Coal Seams	270	0
North Hartley Seam	4	2
Sandstones and three thin Coal Seams ...	200	0
Glenesk Seam	1	8

Mr. Rands gives the following Analyses of Coals from the Burrum:—

Name of Seam.	Water.	Volatile Hydro-Carbons.	Fixed Carbon.	Ash.	Sulphur.	Specific Gravity.	Coke.
I. Whitley's Shaft (Queensland Collieries Company's Seam)	...	26.6	68.4	5.0	...	...	...
II. Beaufort Seam (Beaufort Shaft)	...	31.5	64.0	4.5	...	...	...
III. Burrum Seam	...	29.8	62.2	8.0	...	...	...
IV. Queensland Collieries Company's Seam	2.50	30.35	64.30	2.5 grey.	0.35	1.24	66.8
V. Lapham or Torbanelea Seam (Torbanelea Colliery, Bottom Coal)	2.00	28.00	61.60	8.0 grey.	0.4	1.31	69.6
VI. Ditto (Top Coal) ...	2.25	29.15	66.50	2.1 grey.	...	1.26	68.6
VII. Burrum Seam (Torbanelea Colliery)	2.75	28.00	65.55	3.25 reddish	0.45	1.27	68.6

"Mr. Henderson, C.E., Manager of the Maryborough Gas Works, kindly gave me the following Returns from 20 months' actual work with the Coal from the Lapham or Torbanelea Seam:—

Gas, 10,200 cubic feet per ton of coal; candle-power, 14·73.

Coke, 1,460lbs. per ton of coal; or, 65 per cent.

Tar, 10·5 gallons per ton of coal.

Ammoniacal liquor, 16 gallons per ton of coal.

"This seam has proved, in practice, to be superior to either the Queensland Collieries Company's seam or the Burrum Seam for gas-making purposes.

"The Analyses of coals from the Burrum would show that, with reference to the volatile hydrocarbons, of which, of course, a high percentage is necessary for gas-making purposes, they are not quite as good as Newcastle (N.S.W.) coals. Fourteen samples of the latter averaged 37·55 per cent. of volatile hydrocarbons, including water, while the average of seven samples from the Burrum is 31·5—that is, taking the hydrocarbons and water together.

"The ash, which represents so much of worse than useless matter, is by no means high, the highest result being 8 per cent., and the lowest 2·1 per cent.; the average being 4·6 per cent., as against an average of 4·97 per cent. in the Newcastle (N.S.W.) Coal. It should be mentioned that the Burrum samples are from shallow depths, where the ash is generally higher.

"The sulphur, averaging 0·4 per cent. in the three samples from which I determined it, is very low indeed, and the coal will compare favourably in that respect with coal from any part of the world. The percentage of this constituent is most important in coals used for gas-making. Freedom from sulphur, too, is a great advantage in many metallurgical processes.

"The Cokes from the Queensland Collieries Company's seam, the Lapham or Torbanelea Seam, and the Burrum Seam are all good, coherent, dense cokes, that from the first-named being the densest.

"The Burrum Coal is not so good a steam coal, on account of its tenderness. However, I am of opinion that there will be a great improvement in it in this respect at greater depths." ("Report on the Burrum Coalfield," by W. H. Rands. Brisbane: By authority, 1886.)

It is only since the opening of the railway from Maryborough that the Burrum Coalfield has been worked to any extent worth mentioning. During the last five years, the output has amounted to 124,079 tons, valued at £71,078.

YIELD OF BURRUM COALFIELD.

1883.	6,440	tons raised;	value,	£3,780
1884.	6,150	„	„	3,550
1885.	26,914	„	„	14,950
1886.	39,048	„	„	23,189
1887.	45,527	„	„	25,609
Totals ...	124,079			£71,078

Ipswich Coalfield.

This coalfield is in all probability the equivalent of the Clarence River beds of New South Wales (Jurassic.) It contains an abundant fossil flora and a few fresh-water shells. It appears to be a fresh water formation throughout, although it graduates upwards into the marine beds of the "Rolling Downs" formation.

The Hon. A. C. Gregory, C.M.G., in his "Report on the Coal Deposits of the West Moreton and Darling Downs District" (Brisbane: By Authority, 1876), gives a detailed account of the coal and other beds of the field. He remarks (p. 7) that "the general character of the coals found between Woolloon and Warwick is that of Cannel Coal. It does not cake in coking; gives a large per centage of gas, or oil and paraffine, according to its treatment at a high or low temperature. Its hardness renders it very suitable for export. It burns very freely and leaves a soft white ash.

"From the small proportion of fixed carbon, and its not caking, it does not produce good coke, but a charred coal which, however, burns well; consequently it is not well adapted for blast furnaces, though well suited for reverberatory furnaces. As a steam coal it is best suited for stationary or marine engines, the strong blast of locomotives being apt to blow it through the tubes. It is a very high-class household coal.

"In the Ipswich division the coals are bituminous, coking well; the proportion of gas being small, and the fixed carbon large, they are suited for forges and blast furnaces; are good steam coal when not broken too small, but are so friable as not to bear carriage well, and suffer from exposure to wet, so that the harder varieties, though containing most ash, are found in practice to be most economical in consequence of the smaller proportions of waste.

"In both districts the coal is associated with ironstone bands and beds of boulders, consisting of concretions of oxide of iron, which have replaced fragments of fossil wood. The high percentage of ash in the coal and scarcity of good limestone would, however, be serious obstacles to the profitable working of the iron at the present low prices at which it is imported.

"On part of the North and East, and also on the South, the carboniferous rock rests on Devonian slates, sandstones and limestones, and at a few points on the granite.

"There are extensive tracts of the carboniferous formation covered by basalt, which is most extensively developed in the central part where it forms the summit of the Great Dividing Range, and in the Southern part there are erupted masses of felstone porphyry forming high peaks such as Mount Flinders, and at Cunningham's Gap on the Main Range, but the coal measures do not appear to be much disturbed or altered by these outbursts of igneous rocks, while the manner in which the basalt covers the slate and sandstones indicates that considerable erosion and denudation had occurred prior to the basaltic period.

"The superincumbent basalt is of a much later period th[...] coal deposits, as shown by the fossil wood and leaves found [...] stratum of earth between the basalt and the coal shales of the ([...] Mine, while no fragments of basaltic rock have been found amo[...] coal strata, and there is evidence that the general features [...] country were much altered during the interval between th[...] deposit of coal and the earlier outbursts of basalt."

Mr. Gregory gives the following table of analyses of the c[...] this series:—

Mine or Locality.	Thickness.	Volatile in Coking.	Fixed Carbon.	Ash.	Coke.	Carbon in Coke.
	ft. in.					
Tivoli Mine, North Ipswich	5 6	26·7	66·4	6·9	73·3	90·6
Eastwood Mine, North Ipswich ...	0 7	25·0	63·0	12·0	75·0	84·0
Thompson's Mine, Bundanba	0 5	31·7	62·3	6·0	68·3	91·2
Goodna Mine, Woogaroo	0 4½	28·8	62·2	9·0	71·2	84·4
New Mine, near Tivoli Mine	6 0	30·8	61·0	8·2	69·2	88·2
Thomas's Mine, Bundanba	4 5	29·8	59·2	11·0	70·2	84·3
Aberdare Mine, Goodna...	...	28·8	57·2	14·0	71·2	80·3
Blond & Wright's Mine, North Ipswich	...	26·2	56·4	17·4	73·8	76·4
Lyon's Shaft, Moggill	3 4	38·2	51·0	10·8	61·8	82·6
Brisbane River Seam, Rocky Crossing	...	22·0	50·9	27·1	78·0	65·3
Flagstone Creek, Helidon	...	36·3	47·4	16·3	63·7	74·4
Blackfellow's Creek, West Moreton ...	0 9	42·4	45·6	12·0	57·6	79·2
Hodgson's Creek, Darling Downs ...	...	44·7	42·6	12·7	55·3	77·0
Clifton Mine, Darling Downs	4 5	47·6	42·2	10·2	52·4	80·5
Walloon, West Moreton	...	47·0	36·0	17·0	53·0	67·9
Murphy's Seam, Kedron Brook ...	...	16·0	33·6	50·4	84·0	30·0
For Comparison:						
Waratah, Newcastle, N.S.W.	...	31·0	62·5	6·5	69·0	90·6

In a report "On the Geological Features of the South-Ea[...] District of the Colony of Queensland" (Brisbane: By autho[...] 1879), Mr. Gregory gives the following additional analyses:—

——	Fixed Carbon.	Fluid Hydro-Carbon.	Water.	Equiv[...] to Com[...] Oxyg[...]
Tivoli, Ipswich	72½	...	...	...
Waterstown, Ipswich	69 to 71	7½	1½	1½
Redbank, Goodna	67 to 76	6	2½	2
Jones's, Bundanba	68 to 77	...	...	...
Thompson's, Bundanba ...	66	...	...	...
Thomas's, Bundanba	66	...	...	...

The output of the field from 1860 to 1887 inclusive is estimated at 1,580,932 tons of coal, valued at £735,120. It is possible, however, that between 1860 and 1883 a small proportion of the output credited to Ipswich was produced at the Burrum. On the other hand, it is more than likely that a portion of the coal from Clifton may not have been included in the Returns, as the products of this colliery were to some extent consumed locally.

YIELD OF IPSWICH COALFIELD.

Year.	Tons of Coal Raised.	Value.
		£
1860 to 1883	814,407	414,368
1883	98,310	49,114
1884	114,577	56,475
1885	180,744	71,258
1886	189,608	72,054
1887	183,286	71,851
Totals	1,580,932	£735,120

Jimbour Coalfield.

This field is geologically a part of the Ipswich Coalfield. Its output in 1885 was 2,040 tons, valued at £1,020.

Bowen River Coalfield.

This coalfield, although covering a large area, has from its inland and elevated position not yet taken rank among the producing districts of the Colony.

The Coalfield is identifiable by its fossil contents as the equivalent of the Newcastle (N.S.W.) coal measures (Carbonifero-Permian). It is divided into three series; the lower consisting of about 880ft. of yellow and white sandstones and conglomerates and covered by a series of bedded trappean rocks; the middle (or marine) of grey and yellow sandstones, and blue and grey shales with three or four seams of coal; the upper (or fresh-water) of greyish-green sandstones and grey shales, with five or six coal seams of workable thickness.

Many of the seams at their outcrop are "coked" and destroyed by intrusive sheets of dolerite. From their being rendered hard and accompanied by the hard dolerite the "burnt" seams are unfortunately those which may make their appearance at the surface, while softer uninjured seams are apt to be covered over by alluvial deposits. A good seam 5½ft. thick was cut in a bore on Pelican Creek at a depth of 310 ft. Another good coal seam 6ft. thick crops out on the same creek near the bore. Samples from the latter are to be sent to the Exhibition.

It will be seen from the descriptions of Gympie and other goldfields that rocks of this age have frequently suffered metamorphism and become metalliferous.

Dawson and Mackenzie Coalfield.

The Coal Measures of the Bowen River Series extend from the heads of the Isaacs River on the North to the heads of the Dawson on the South, a distance of over 300 miles. In this area several Coal Seams are known to exist, but have not been worked to any extent.

One thick Coal Seam on Walker's Creek, near Nebo, is an anthracite containing a higher percentage of fixed carbon and a lower percentage of earthy impurities than any Coal of its class known in Queensland or New South Wales. It approaches in composition some of the best anthracites of Wales and Pennsylvania.

The following is an analysis of this seam:—

Water	2.99
Volatile Hydrocarbons	8.71
Fixed Carbon	84.74
Ash	3.56
	100.00

List of Localities where Minerals, yet undeveloped, are known to exist.

The names which follow are those of localities where the minerals referred to are found in sufficient quantities to warrant the belief that they will at some future time be payable. It is impossible to name all the localities where minerals have been detected in minute quantities. The exclamation marks (!) denote localities where the mineral referred to exists in very large quantities.

Gold.

S. Lat. ° ′	E. Long. ° ′	Locality.	S. Lat. ° ′	E. Long. ° ′	Locality.
25·42	151·45	Ban Ban.	26·30	152·15	Moona Waamba.
19·30	145·	Broken River.	17·40	146·10	Mourilyan Harbour.
19·36	145·47	Continong.	19·30	146·50	Mount Elliott.
16·20	145·6	Daintree River.	20·52	147·20	Mount Wyatt.
27·30	152·50	Enoggera.	26·45	152·3	Nanango.
27.10	152·15	Eskdale.	23·53	146·53	Omega.
21.12	149·	Eton.	13·25	143·	Peach River.
21.6	148·30	Eungella.	21·25	149·15	Plane Creek.
19.53	146·30	Fanning River.	25·5	151·57	St. Agnes Creek.
10.35	142·12	Hammond Island.	27·49	152·47	South Pine.
21·55	150·8	Hunter Island..	19·25	146·10	Star River.
26·28	152·40	Imbil.	20·12	147·15	Strathalbyn.
12·40	143·20	Janet River.	21·22	147·30	Suttor River.
17·35	145·30	Johnstone River.	17·2	145·32	Tinaroo.
13·15	143·30	Lockhart River.	25·0	151·25	Yarrol.
26·30	152·22	Maunmbar.			

Silver and Lead.

S. Lat. ° ′	E. Long. ° ′	Locality.	S. Lat. ° ′	E. Long. ° ′	Locality.
13·52	143·12	Coen River (South).	25·0	151·53	Gin Gin.
25·29	151·56	Degilbo.	20·55	149·24	Scrubby Creek, Connor's Range.
20·22	140·12	Dugald River.			
19·28	143·40	Gilbert River.	25·0	151·27	Yarrol.

Copper.

25·5	151·42	Boolboonda.	18·50	139·15	Gregory Downs
25·33	152·13	Clifton.	24·10	151·24	Iveragh.
26·53	152·2	Coogar Creek.	19·40	146·42	Keelbottom.
25·50	152·17	Culgoa Creek.	18·55	145·45	Mt. Fox, Cardwell.
23·40	150·20	Dee River, Rockhampton.	20·0	148·10	Mt. Greentop, Bowen.
			21·23	148·16	Mt. Gothard, Nebo.
18·35	144·12	Eniasleigh River.	21·24	148·25	Mt. Hess, Nebo.
22·50	149·29	Fort St. John, Broadsound Range.	28·32	151·45	Pikedale.
			23·0	150·30	Shannon Creek, Rockhampton.
25·44	152·14	Gigoomgan.			
22·36	149·58	Glenprairie.	19·7	146·10	Star River.
26·22	152·22	Gobango Creek.	17·12	144·15	Walsh River.
21·42	149·27	Green Hills, Broadsound.	23·35	150·8	Westwood.
			25·18	151·39	Wolca.

Antimony.

19·40	144·45	Gray's Creek.	20·	146·50	Ravenswood.

Bismuth.

20·40	140·47	Cloncurry.	25·25	151·58	Mount Shamrock.
21·0	140·22	Cloncurry, Top Camp.	19·10	143·47	Percy River.
17·28	145·14	Irvinebank.	18·58	143·37	Robertson River.
19·0	146·0	Kangaroo Hills.	...	...	...

Iron.

20·17	140·10	Dugald River.	21·40	140·40	Mount Pisa!
19·27	139·43	Gunpowder Creek.	27·15	152·50	Pine River (Chrome Iron).
18·57	145·35	Kangaroo Hills!	17·35	145·25	Wild River!
20·40	140·35	Mount Leviathan!!	...	...	...

Manganese.

23·44	151·20	Gladstone.	23·16	150·18	Ridgelands.

Mercury.

19·27	144·45	Broken R., Burdekin.	26·18	151·8	Black Snake.

Baryta.

25·11	151·35	Potosi, Mount Perry.

Plumbago.

19·45	147·50	Cape Upstart.	26·10	152·33	Gympie.

Limestone, Marble, and Gypsum.

S. Lat. ° ′	E. Long. ° ′	Locality.	S. Lat. ° ′	E. Long. ° ′	Locality.
23·3	145·13	Aramac.	16·30	144·12	Mitchell River, Cape York Peninsula.
20·50	148·3	Bowen River.	26·30	147·55	Mitchell, S. & W. Railway.
24·9	151·13	Boyne River.	15·35	145·5	Mt. Byerley.
19·25	144·50	Broken R., Burdekin.	19·58	148·7	Mt. Roundbuck, Bowen
19·7	145·20	Burdekin River.	16·50	145·12	Northcote.
22·20	142·30	Collingwood (Gypsum).	21·55	150·8	Northumberland I'ds.
22·49	147·48	Copperfield.	15·58	144·7	Palmer River.
23·20	145·20	Coreena.	19·45	146·47	Reid River.
19·50	146·10	Dalrymple.	20·45	143·10	Richmond Downs.
17·35	145·15	Dry River.	23·20	150·18	Rockhampton.
19·45	146·27	Fanning River.	21·48	144·20	Rockwood.
18·45	139·10	Gregory River.	19·20	146·10	Star River.
26·10	152·33	Gympie.	12·15	143·5	Temple Bay.
27·43	152·45	Ipswich.	20·44	143·45	Telemon.
19·25	140·7	Kamilaroy.			
24·33	150·30	Koonigal.			

And innumerable other places, especially over the Western Downs ("Rolling Downs Formation").

Coal.

21·0	148·0	Bowen River (numerous localities).	24·55	146 45	Malta.
25·0	152·20	Burrum Coalfield (numerous localities).	15·35	145·0	Oakley Creek, Cooktown.
19·19	146·49	Cleveland Bay.	24·10	151·40	Rood's Bay.
24·0	149·0	Dawson and Mackenzie Coalfields (numerous localities).	23·23	150·18	Stewart's Creek, Rockhampton.
20·40	144·40	Flinders River.	22·38	149·42	Styx River.
27·30	152·30	Ipswich Coalfield (numerous localities).	22.27	143·22	Vindex.
21·40	142·0	Kynoona.	15·25	144·45	Welcome River, Cooktown.
15·40	144·10	Little R., Cooktown.	...	...	Western Downs (in numerous localities).

Opals.

The following are localities from which valuable opals have been obtained. The opals are found in nodules of ferruginous siliceous sandstone and siliceous ironstone, either in the "Desert Sandstone" formation or denuded out of it, and lying on the surface of the underlying "Rolling Downs" Formation. The whole of the area over which the Desert Sandstone extended—the western half of the colony—might therefore be given as the locality in which "opal mines" are "undeveloped."

S. Lat. ° ′	E. Long. ° ′	Locality.	S. Lat. ° ′	E. Long. ° ′	Locality.
25·23	145·15	Blackwater Creek.	23·32	141·32	Mayne River.
25·50	143·35	Bulgroo.	26·20	144·20	Nickavilla.
25·57	142·47	Keeroongooloo.	22·32	143·12	Winton.

Diamonds.

I cannot vouch for the accuracy of the information here given.
Diamonds are reported to have been found at:—

S. Lat. ° ′	E. Long. ° ′	Locality.	S. Lat. ° ′	E. Long. ° ′	Locality.
26·34	153·0	Yandina.	28·0	153·5	Tabragalba.

Artesian Water in the Interior.

The "Rolling Downs Formation" of the Western interior has given rise by its decomposition to a soil which stands almost unrivalled for the nutritive qualities of its grasses, and would be admirably fitted for agriculture had not nature denied it a sufficient rainfall.

It is only since the beginning of the present year that this mistake on the part of nature has been artificially remedied by boring. The first bore to strike water was that at Barcaldine (691ft 9in. deep). This well pours out a stream of water yielding 175,416 gallons per day, at a temperature of 101 deg. The Artesian Well at Blackall struck at 1,666ft., a supply which now overflows (though restricted by piping), at the rate of 300,000 gallons per day, at a temperature of 119 deg. At Saltern Creek another Artesian Well, 978½ft. deep, yields 17,160 gallons per day, at a temperature of 112 deg. The Sandringham Artesian Well, 140ft. deep, yields 40,000 gallons per day. Artesian Water has lately been tapped at Mount Margaret Station, near Thargomindah, at a still shallower depth.

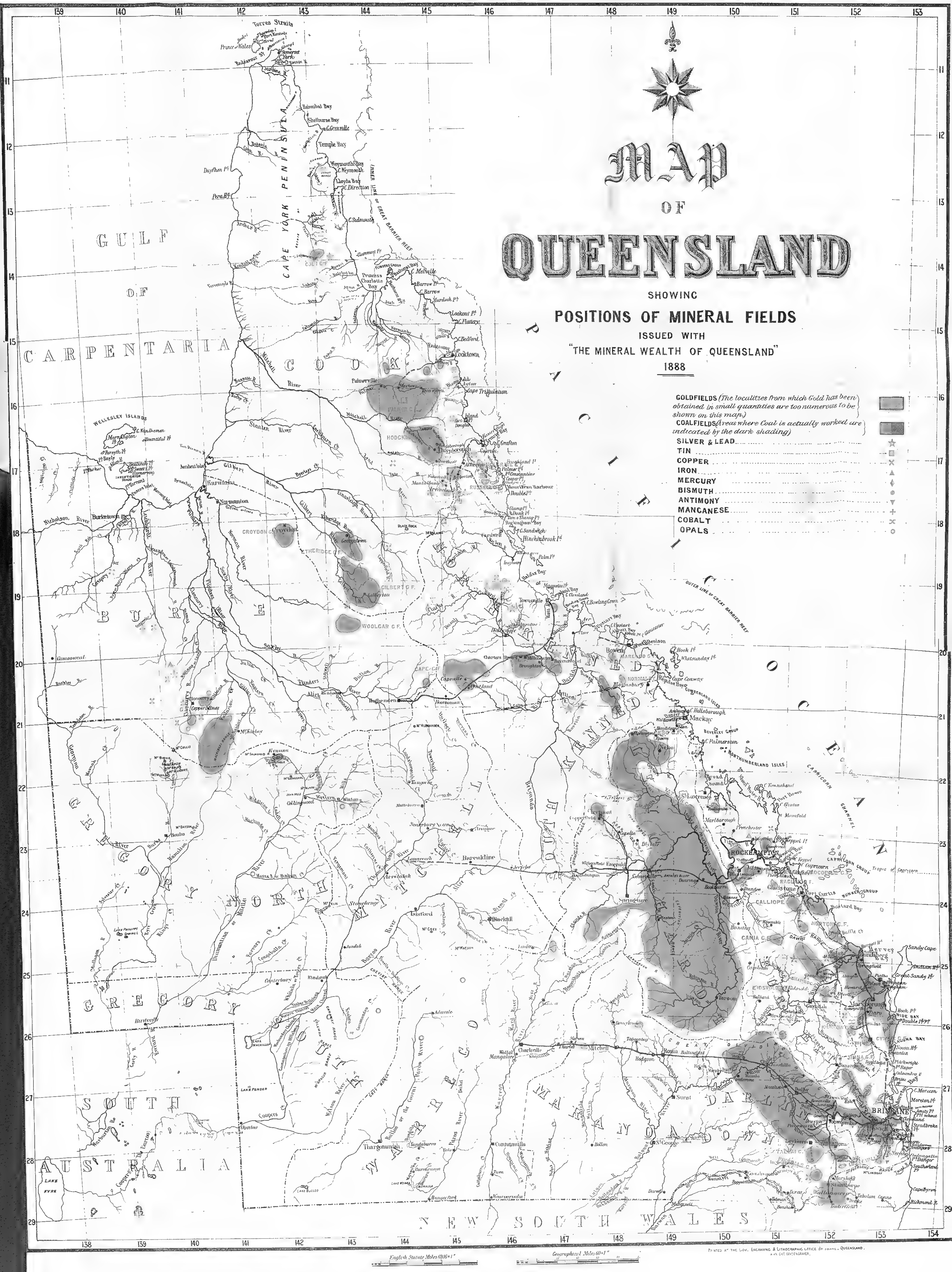
NOTE.—*In the small map attached to this pamphlet, the principal mineral localities are shewn, so far as the scale permits.*

INDEX.

Mineral Fields.

ERRATA.

Page 27, line 19. *For* Men's' *read* Men's.
Page 28, line 31. *For* limestone *read* Sandstone.
Page 38, line 4 from bottom. *For* schists—chiefly hornblendic—and *rea* schists, chiefly hornblendic—and.
Page 41, line 11. *Insert* " *before* Gooroomjam.
Page 41, line 25. *Insert* " *after* greenstone.
Page 42, line 4 from bottom. *For* Plugs *read* "slugs."
Page 43, line 2 from bottom. *Erase* " *before* Discovery.
Page 44, line 2. *Erase* " *after* silver *and insert* " *before* Several.
Page 44, line 21. *Erase* " *before* 1,041.



MAP OF QUEENSLAND
SHOWING
POSITIONS OF MINERAL FIELDS
ISSUED WITH
"THE MINERAL WEALTH OF QUEENSLAND"
1888
GOLDFIELDS (The localities from which Gold has been obtained in small quantities are too numerous to be shown on this map.)
COALFIELDS (Areas where Coal is actually worked are indicated by the dark shading)
SILVER & LEAD
TIN
COPPER
IRON
MERCURY
BISMUTH
ANTIMONY
MANGANESE
COBALT
OPALS
GULF OF CARPENTARIA
PACIFIC OCEAN
SOUTH AUSTRALIA
NEW SOUTH WALES
CAPE YORK PENINSULA
English Statute Miles 69.16 = 1"
Geographical Miles 60 = 1"

1889.

QUEENSLAND.

TARANGANBA GOLD MINE.

(REPORT BY ROBERT L. JACK, GOVERNMENT GEOLOGIST, ON)

Presented to both Houses of Parliament by Command.

TO THE HONOURABLE THE MINISTER FOR MINES AND WORKS.

Taranganba is situated on portion 240, about a mile and a-half south of the township of Yeppoon, and about 22 miles north-east of Rockhampton in a straight line. It can be reached from the sea by Ross Creek, which is navigable by small craft, or by the coach road (about 6 miles long) from Tanby Station, on the railway from Rockhampton to Emu Park. The mines are situated on Pigsty Hill, a grassy rise about 110 feet above the sea-level, the Eastern Hill, due south of the Pigsty, and rising to a height of about 230 feet, and the Western Hill, west of the Eastern, and about the same elevation.

The three hills above referred to consist mainly of quartzites, in which a good deal of fine pyrites is invariably present. These rocks are intersected by dykes of acidic felstone, weathering into kaolin or clay, and running from north and south to north-east and north-west; and by a number of reefs or lodes having, as a rule, a similar trend. The accompanying plan shows the position of the mining and prospecting operations, connected with the Lands Department's plan of the selection (now the freehold) No. 240.

I arrived on the ground on 16th March, and spent five days in mapping and prospecting, accompanied by Mr. James Smith, collector to the Geological Survey, and Mr. Robert Welch, an experienced miner from the Mount Morgan District. Messrs. Smith and Welch spent the whole time in grinding and washing the specimens which I selected for the purpose. Mr. Welch "panned off" on the spot. I watched the operation closely and was highly satisfied with his exceedingly conscientious manipulation.

In view of the conflicting rumours regarding this mine, I may here mention in detail the method observed in my inspection and the precautions taken to procure unsophisticated specimens, and to preserve them from the possibility of being interfered with. In the first place, no sample (with a few exceptions, afterwards specified) was taken which had ever seen daylight before. Every sample was taken from the solid rock, the exposed surfaces having first been hewn off to a depth of 4 or 5 inches. The samples intended for assay or for treatment in my own office were immediately bagged and marked, and the bags when not in my sight were kept under lock and key. Thirty-seven samples were "panned off" on the spot. Forty-one were ground at Townsville by Mr. W. Wood, caretaker of the Museum, under my eye, and "panned off" by myself. Seventeen were assayed by Mr. E. B. Lindon, of Brisbane, and seventeen by Messrs. Coane and Clarke, of Charters Towers. As a check on the other operations all the samples brought to Townsvile were submitted to the iodine test, first suggested by Mr. Skey, of New Zealand, substituting, however, asbestus for filter-paper, as suggested by Mr. A. W. Clarke, of Charters Towers. By this modification of Skey's process the purple colour denoting the presence of gold can be seen on a pure white ground, instead of being obscured by the black of the burnt paper, and consequently very minute traces of gold can be detected. Appendix A gives a tabular view of the results of the various assays and other tests mentioned in the text.

My examination of the various mining and prospecting operations commenced on the northern slope of the Pigsty Hill, near the company's office, and extended southward along the Eastern Hill, and then northward over the Western Hill. In the following notes the different sections are described with reference to marks on the plan. I shall have to refer occasionally to two pamphlets—(1) "The Celebrated Taranganba Gold Mine, its History, Description, and Prospects," Sydney, Samuel E. Lees, 1887, published for the directors, and (2) "Directors' Interim Report, Taranganba Proprietary Gold Company, Limited," Sydney, S. E. Lees, 1888. This interim report is practically an introduction to the report of I. A. H. Theodore Ranft, M.E., on the Taranganba Gold Mine, dated 25th May, 1888.

Trench M—O.

Trench nearly east and west across Pigsty Hill. This is "No. 1 trench" of Mr. Ranft's report. Mr. Ranft gives (pp. 11 and 12) three assays from this trench, viz.: No. 14, (from immediately west of dyke), 4 dwt. 5 gr. per ton; No. 15 (between central and eastern dyke), 2 dwt. 14 gr. per ton; and C (west of average No. 14), 6 oz. 13 dwt. 9 gr. per ton. The trench intersects chiefly quartzites in flaggy beds (in which the alternations of coarser and finer materials prove that the dividing planes are stratification and not cleavage). At the east end the quartzites are nearly vertical, with a north and south strike. They then dip at 45 degrees to the north, and are highly contorted to a point 84 links west of M. From that point westward they resume the north and south strike and are vertical.

At

At 84 links from M a nearly vertical vein (1) runs north and south. It is about 3 feet in width, and is characterised by bulges of quartz and yellow and black ochreous veins. From samples panned off on the ground "no prospect" was obtained, but from a sample taken to Townsville (1, C. and C.), Messrs. Cone and Clarke, of Charters Towers, obtained on assay a result of 4 dwt. 21 gr. of gold, and 8 dwt. 4 gr. of silver per ton. An iodine test of part of the sample showed a trace of gold, although "no prospect" could be obtained in the dish at Townsville.

Thirty-eight links west of vein (1), a second vein (2) runs north, 10 degrees east, and is nearly vertical. It is highly ferruginous, and averages 3 feet in width. The pan gave "no prospect," both on the ground and at Townsville. An assay by Mr. E. B. Lindon, of Brisbane (1, E.B.L.), showed "no gold," but a trace of gold was detected by the iodine test.

Twenty-eight links west of (1) vein (3) is cut. It is about $2\frac{1}{2}$ feet in width, runs south, 20 degrees east, and underlies to east 20 degrees north. Besides quartz, it contains a good deal of black limonite, and in parts a little resembles some varieties of Mount Morgan stone. The pan gave "no prospect" both on the spot and at Townsville. The iodine test, however, detected a trace of gold, and Mr. Lindon reported a trace, as the result of an assay (2, E.B.L.).

A kaolin or decomposed acidic felstone dyke crosses the trench 175 links west of M. It is 6 feet wide and apparently runs north and south, though its course is not distinctly traceable on the surface. The pan showed "no prospect" on the ground.

I made a collection of fragments from thin filmy veins of quartz adhering to the bedding planes of the quartzite from a spot 21 links west of M, under the impression that in such veins gold might possibly be concentrated, but the dish showed "no prospect."

We panned out a prospect from the north side of the trench, immediately west of the kaolin dyke, 3 feet above the floor of the trench (in a sort of quartzose casing, partly ferruginous, on a bed of quartzite), but got "no prospect." This is probably the place from which Mr. Ranft got his sample—No. 14—which gave, on assay, 4 dwt. 5 gr. of gold to the ton.

We next sampled a black, discoloured, thick, vertical bed of ferruginous quartzite, 230 links west of M, but got "no prospect" in the dish.

A tunnel is driven to south 35 degrees east for 45 links from the trench, at a point 370 links west of M. A black vein of ironstone and quartz crosses the mouth of the tunnel from east-south-east to west-north-west and underlies to north-north-east. A sample panned out on the spot gave "no prospect." Another sample panned at Townsville showed a single very fine colour of gold, and an assay by Messrs. Coane and Clarke gave 1 oz. 14 dwt. 7 gr. of gold and 16 dwt. 8 gr. of silver to the ton. The iodine test demonstrated the presence of gold.

Several large veins of similar character cross the trench west of the mouth of the tunnel. They are, however, not continuous to the floor of the trench and are obviously not true reefs.

A mass of small veins of black limonite and quartz is seen at the inner end of the tunnel. These veins underlie to the east at low angles, but are not continuous for any distance. An average sample panned on the ground gave "no prospect."

Having exhausted the likely places, I finally broke off a number of pieces from the quartzite all over the trench, and an average sample was panned off on the spot, with the result of "no prospect."

Trench Q—S.

This trench runs south from the shaft Q near the top of Pigsty Hill. The country rock is of vertical quartzite, striking north-west and south-east. The trench, from a few feet north of the point R (see plan), is driven on the course of a north and south lode, which underlies a little to the west. At the south end of the trench it is at least 8 feet wide, though near R. it is not more than 12 inches. It consists of quartz and alternate ironstone and jasper-like ochreous veins. From a mixed sample taken from the lode near S., Mr. Welch panned out a small prospect (less than 2 dwt. to the ton) of exceedingly fine gold. In a portion of the same sample taken to Townsville the iodine test gave a faint trace of gold, although the pan gave "no prospect." In a third portion (3, E.B.L.) Mr. Lindon found "no gold" by assay.

Trench U—V.

This trench runs N.E. across the Pigsty Hill a little south of the summit. It is about 7 feet deep at the south west end, but the remainder is only superficial. The lode seen in Q—S. is also cut in U—V. It occupies 15 feet of the end of the trench near V. From a sample (*a*) taken 15 links from V., Mr. Welch panned out a few exceedingly fine "colours" of gold. From a portion of the same sample taken to Townsville, Messrs. Coane and Clarke made an assay (3, C. and C.) which gave 4 dwt. 21 grs. of gold and 5 dwt. of silver to the ton. The iodine test showed a trace of gold, but the pan gave "no prospect." Another sample (*b*) taken at 33 links from V (about 2 feet from the footwall of the lode), gave "no prospect" on the ground. A portion of the same sample taken to Townsville gave a trace of gold by the iodine test, and "no prospect" in the dish. Mr. Lindon made an assay (4, E.B.L.) of another portion and obtained only a trace of gold.

Below the footwall of the lode nearly vertical thick bedded quartzites, with a north and south strike, are exposed for 30 feet towards U. They are occasionally ironstained. Beyond this the trench rarely goes through the broken surface and shows nothing of any consequence.

The lode seen in the trenches Q—S. and U—V. can be traced on the surface for about 30 feet south of V.

Trench R—T.

This trench crosses the summit of Pigsty Hill from west to east, commencing (at R) at the trench Q—S. It intersects for the most part quartzites with a north-north-west strike and vertical dip. A dyke of felstone, about 2 feet wide, crosses the trench from south 10 degrees east to north 10 degrees west, 27 links from R. A vein (*a*) of ferruginous quartz crosses at 78 links from R. It has a steep underlie

underlie to the south-west, and is 2 to 4 feet wide. A sample panned on the spot by Mr. Welch gave "no prospect"; 110 links from R another reef or vein crosses the trench, underlying at 50 degrees to west-south-west. The trench is here rather shallow, and not much can be seen of the reef. It consists apparently of two masses of quartz., each 2½ feet in thickness, separated by a "horse" of quartzite.

Tunnel W—Q.

This tunnel is driven nearly eastward into the Pigsty Hill past the bottom of shaft Q. Measured by the shaft the tunnel is 38 feet below the level of trench Q—S.

For the first 44 links from the mouth (W) the tunnel traverses a decomposed felspathic rock, which underlies at a high angle to the east under a compact grey flinty quartzite rock, the latter continuing to 47 links; thence to 52 links, quartzite in lenticular, nearly vertical bands in a soft felspathic matrix; thence to 71 links, compact grey flinty quartzite; thence to 98 links, massive grey and dark flinty quartzite; thence to 113 links, quartzite and soft clayey matter. At 113 links a black ferruginous quartz vein (H2), 8 inches thick, is met with and followed for 10 feet to south-east and for 5 feet to north-west. It underlies at about 60 degrees to the east. This is probably the "strong leader, 6 inches thick," referred to by Dr. J. R. M. Robertson in his report as cut at 75 feet (see "The Celebrated Taranganba Gold Mine," p. 26) as having given "good prospects of gold in a state of fine division," and as having yielded, on assay by Mr. W. A. Dixon (*Ibid.*, p. 30), 1 oz. 16 dwt. of gold per ton. A sample of the vein which I took to Townsville gave "no prospect" in the dish, but the iodine test detected the presence of gold, and Messrs. Coane and Clarke reported, as the result of an assay (16, C. and C.), "traces of gold and silver."

For 14 links beyond H2 the tunnel cuts through a decomposing felspathic rock. Beds of quartzite dipping at a high angle to the east next extend to 22 links, and alternate soft clay and quartzite bands to 31 links. At 31 links is a vertical north and south leader of manganese oxide. A drive to south 21 degrees east for 42 links from the foot of shaft Q shows in its face a reef of solid quartz with black stains about 2 feet wide underlying to the west. It throws off horizontal floors of quartz towards the west. I took a sample from the face (No. 2) to Townsville. The iodine test gave a trace of gold. The dish gave "no prospect," and an assay (17, C. and C.) by Messrs. Coane and Clarke gave "traces of gold and silver." The reef is also driven on for 31 links to west 42 degrees north. At the face it is apparently over 2 feet in thickness, with a smooth hanging wall. It consists mainly of manganese and iron ore, with quartz veins. I took a sample (No. 3) of chips broken from all across the face, which, on assay (16, E.B.L.) by Mr. Lindon, gave "no gold."

Solid quartzite occupies the tunnel for 28 links east of the bottom of shaft Q. Quartzite, less solid and mixed with clayey matter, extends from 28 to 63 links. For a short distance further is rubbly quartzite mixed with clay, and especially near 63 links, a few ironstone streaks (nearly vertical) and copper stains. A little further are two short drives (M 2) to north and south of the tunnel. The southern face shows a manganese and iron-stained leader underlying to the west. The northern face shows slightly copper-stained veins in every direction, but nothing worth following further.

From M2 quartzites nearly vertical, but dipping at a high angle to the west, continue for 54 links. At 54 links a soft white clay (decomposed felstone) begins to appear in the roof of the tunnel. At 73 links it has come down about 3 feet lower. From that point it makes an arch rising nearly to the roof, and (at 100 links) comes down nearly to the floor. It is beginning to rise again at the inner face of the tunnel. I have not coloured this evidently intrusive mass of felstone on the map, as it is impossible to say where, if at all, it reaches the surface, and its connection with the dyke seen in the trench M—O, or with that seen in trench R—T can only be conjectured.

I took to Townsville a sample (No. 4) from quartzite at 38 yards from the mouth of the tunnel. Mr. Lindon's assay (17, E.B.L.) gave "no gold." A portion of the sample panned off at Townsville gave "no prospect," but the iodine test afforded a faint trace of gold.

Apparently the lode seen in trenches Q—S and U—V is not cut in the tunnel W—Q, or at least I failed to recognise anything to represent it. It shows signs of dying out near R in the trench Q—S, a little to the south of the line of the tunnel.

The stone going through the rollers in preparation for chlorination was being taken from the paddock at the mouth of shaft Q, and probably came for the most part from the drives in tunnel W—Q, although possibly some of it may have been derived from the lode in trench Q—S.

The Big Cutting, X—A1.

This is a nearly north and south cutting into the Eastern Hill, from the level of the saddle between that and Pigsty Hill. The cutting averages 40 links in width across the floor, with a slight "batter." From the mouth of it to a shaft (Z) sunk in the floor, the distance is 80 links, and at the shaft the walls are about 12 feet above the floor. From the shaft to the high face is 105 links. The face is 33 links in height.

The eastern wall of this portion of the cutting shows grey quartzites, dipping at a high angle to the south-west. A system of joints, or possibly cleavage-planes, has a low underlie to east-north-east. The joints are in some cases small step-faults, and divide the quartzites into what are apparently beds of from 1 to 3 feet in thickness. The planes dividing these pseudo-beds have generally some layers (up to 3 in. in thickness) of fine flakey veins of quartzite. A sample collected from these veins showed "no prospect" when washed on the ground. The western wall shows the backs or tops of similar joint-planes. The opening from the cutting into trench Z—C1 shows thin beds of quartzite, much contorted, but dipping on the whole to the north-east, overlying a solid bed of quartzite about 20 feet thick. This bed must dip under the floor of the Big Cutting into shaft Z.

The high face of the cutting shows contorted, rather thin, bedded quartzites, striking south-south-east. The only thing resembling a lode or reef is about 6 feet from the end of the face. It is a nearly vertical seam of laminated white clay underlying slightly to the west. It is nearly a foot wide at the floor, but thins out near the top of the face, and in the next higher floor it cannot be traced with certainty. It is probably a line of fault.

We

We prospected on the spot, in every case with negative results, a number of samples from the high face as follows :—

(*a.*) East end of face.
(*b.*) Nine feet from east end.
(*c.*) Sixteen feet from east end.
(*d.*) Nineteen feet from east end (thin beds quartzite on east side of clay-seam).
(*e.*) Twenty-four feet from east end (west side of clay-seam).
(*f.*) West end of face (joint-plane).

In addition to the samples panned off on the spot, I took a number of samples for treatment at home and assay :—

1. East end of face. In pan, one fine "colour" of gold. With iodine test, a trace; Coane and Clarke's assay (4, C. and C.) 4 dwt. 21 gr. of gold, and 5 dwt. 14 gr. silver per ton.
2. Five feet from east end. In pan, "no prospect." With iodine, a trace of gold. Mr. Lindon's assay (5, E.B.L.) a trace.
3. Ten feet from east end. In pan, "no prospect." With iodine test, a trace of gold.
4. Fifteen feet from east end (on face of fault underlying to west). In pan, "no prospect." With iodine test, a trace of gold. Coane and Clarke's assay (5, C. and C.), traces of gold and silver.
5. Twenty feet from east end. (Thin beds of quartzite on east side of clay-seam). In pan, "no prospect." With iodine test, a trace of gold. Mr. Lindon's assay (6, E.B.L.), "no gold."
6. Twenty-five feet from east end. In pan, "no prospect." With iodine test, a trace of gold.
7. West end. In pan, "no prospect." The iodine test, and Mr. Lindon's assay (7, E.B.L.), both show a trace of gold.

Shaft Z is said to be about 45 feet deep (from the floor of the big cutting); I found it, however, nearly full of water.

South of the high face, the workings in the cutting are much shallower. The last of them (near A1) is probably about 47 feet above the level of the floor of the lower part of the cutting. The only thing in the upper portion of the cutting at all resembling "stone" is a flake of black limonite, about 1 in. thick, which can be traced for 40 feet to north-north-west from the middle of the cutting near A1. It underlies to west-south-west at 60 degrees. Samples prospected on the spot gave "no prospect." The bulk of the stuff excavated from the Big Cutting has been stacked, and it appears from a recent report of the Directors to have been represented to them as likely to yield 10 ounces to the ton. An inspection of the heap proves it to consist of quartzites, similar to what may be seen in the walls and faces of the cutting, and judging from the tests, prospects, and assays from the latter, as well as from the general appearance of the mass, I have no hesitation in regarding it as practically worthless.

Trench Z—B1.

This trench (referred to by Mr. Ranft as trench No. 2) averages about 8 feet in depth. For the first 36 links from B1 the walls have tumbled in. At 36 links a solid reef of quartz, 4 feet in thickness, runs south-south-east. It is vertical, and some of its joints are coated with black limonite. A sample panned off on the ground gave "no prospect." The next 20 links are of contorted thin-bedded quartzites, with occasional yellow ochreous streaks, dipping on the whole at high angles to east-south-east. Fifty-six links from B1 is a hard compact dyke of silicated felstone, 18 links in thickness. At the western side of the dyke commences what may be called a lode. It consists essentially of a breccia of quartzite débris, in which are, however, many masses of quartzite beds, apparently in their original position. The rest is yellow, brown, and black limonite, and manganese oxide, for the most part in vertical veins and streaks and occasionally in horizontal films and veins. The direction of this large lode (which extends in the cutting from 74 links to 143 links west of B) is not clear, as the lode cannot be traced on the surface owing to the accumulation of soil, but it appears to run north 10 degrees west and to underlie at a high angle to west 10 degrees south. A sample (No. 1) taken from 5 links from the east edge of the lode gave "no prospect" when panned off on the spot. The same result was obtained from another portion panned off at Townsville. Mr. Lindon's assay (8, E.B.L.) gave "no gold." Even the iodine test failed to detect a trace. Sample No. 2, consisting of chips from the likeliest places all over the lode gave "no prospect" in the pan both on the spot and at Townsville. Mr. Lindon's assay (9, E.B.L.) showed traces of gold. The iodine test of another portion gave no trace.

From the western edge of the lode as far as 225 links from B1 the trench exposes nearly vertical contorted quartzites, sometimes in thick and sometimes in thin beds.

Two hundred and twenty-five links from B1, a vertical reef runs south-south-east. It is about 3 feet thick, and consists mainly of quartz, which is honeycombed and ferruginous in parts. Promising samples (No. 3) panned off on the spot and at Townsville gave "no prospect." The iodine test gave a faint gold trace. Mr. Lindon's assay (10, E.B.L.) gave a trace of gold.

From 225 links to 280 links a solid mass of quartzite is exposed in the trench running from north north-west to south-south-east. It is yellow and ferruginous in parts, but I take it to be part of the country rock. We got "no prospect" from a sample taken near the west end of the mass and panned out on the spot. From 280 links to the Big Cutting, the trench cuts only grey quartzite.

Trench Z—C1.

This trench is in the same line with the last, commencing (at Z) at the western side of the Big Cutting and running westward along the northern slope of the Eastern Hill. The portion near the Big Cutting has already been described. The rest of the trench, which is shallow and partly tumbled in, exposes an occasional glimpse of quartzite and red surface-wash.

TRENCH E1—H1.

This trench (referred to in Mr. Ranft's report as "Trench No. 3") runs east and west across the north slope of the Eastern Hill, 222 links south of the upper end of the "big cutting."

At M1, 48 links east of D1, is a felstone dyke, the width of which, however, cannot be seen, as the trench is crossed at this place by the roadway up the hill. The whole of the trench west of the dyke shows vertical flags of grey quartzite. A sample from D1 panned off on the spot gave "no prospect." Another sample (No. 1) taken 14 links west of D1, on being panned off at Townsville, gave "no prospect," but Mr. Lindon's assay (11, E.B.L.) showed a trace of gold, as did also the iodine test. Sample No. 2, from a hole near the bottom of the southern side of the trench (from which about 2 cubic yards have been excavated) 61 links west of D1, gave at Townsville "no prospect" in the dish, but Mr. Lindon's assay (12, E.B.L.) and the iodine test both showed traces of gold.

Ninety-six links east of D1 a 2-feet kaolin dyke runs south 10 degrees east, with an underlie to west 10 degrees south. A compact felstone dyke, 4 feet thick, commences 26 links west of E1. The remainder of the trench between M1 and E1 shows only quartzites (occasionally iron-stained), nearly vertical and striking north-north-west. A yellow ferruginous portion of the thin-bedded quartzites, 72 links east of M1, gave "no prospect" in a sample washed on the spot. A sample (No. 3) of "rubbly" quartzite from 115 links east of M1 gave at Townsville "no prospect" in the dish, but a trace of gold was detected by the iodine test.

TRENCH F1—G1.

This trench (referred to by Mr. Ranft as the "conglomerate trench") is almost a prolongation (to the east) of Trench E1—H1, its western end (F1) commencing only 59 links south of E1.

A soft kaolin (in all probability the same which is cut in trench ZB1) extends from about 108 to 157 links west of G1. Between the kaolin and F1 are thin-bedded gnarled quartzites striking south south-east, and underlying at high angles to west-south-west. A sample (No. 1) from 14 links east of F1 gave, at Townsville "no prospect" in the dish; a trace of gold by the iodine test, and traces of gold and silver by Coane and Clarke's assay (6, C. and C.). Sample No. 2 (yellow ferruginous quartzite débris) from 3 feet west of the kaolin gave at Townsville "no prospect" in the dish, but a trace of gold by the iodine test. Ninety links from G1 a quartz vein, varying in thickness up to 12 inches, and stained red and black with iron oxides, underlies to the east. A sample (No. 3) gave "no prospect" in the dish, both on the spot and at Townsville. Mr. Lindon's assay (13, E.B.L.) showed no gold. The iodine test gave a trace.

SHAFT S1.

This shaft is about 14 feet deep, but had a few feet of water in the bottom when I visited it. It is to the south of and about 20 feet lower than the summit of the Eastern Hill. It is said to have been sunk by the Mount Morgan Company when the Taranganba property was under offer to them. It has been sunk on a lode which is at least 18 feet wide and runs nearly north and south. A specimen from the bottom (not now accessible) is said to have given 22 oz. 4 dwt. 6 gr. of gold per ton (Dr. Robertson's report in "The Famous Taranganba Gold Mine," p. 22). Another "special sample" from this shaft, said to have assayed for 7,787 oz. 5 dwt. 23 gr. to the ton, is mentioned by Dr. Robertson (*Ibid*, p. 23). I was informed that this specimen was reported to have been found by Mr. Barton, one of the directors.

The lode is of quartz and some felspathic material with a great deal of manganese oxide and limonite.

In view of the rich assays above quoted, and the great size of the lode, I should have liked to prospect numerous samples from the shaft itself, but owing to the condition of the shaft this was a matter of some difficulty.

A sample of nearly pure manganese ore from 3 feet below the mouth of the shaft was panned off on the spot, but gave "no prospect." Next twenty pieces of nearly pure maganese oxide, taken at intervals from the western side of the shaft as far as I could reach, were prospected with the same result. The like want of success attended the panning out of a number of ferruginous and quartzose fragments taken at intervals from up and down the shaft. I next took from the heap, after removing the surface, five samples for assay and testing at Townsville. These (the only specimens I did not actually hew out of the solid rock never before exposed) yielded as follows :—

Marks.	Coane and Clarke's Assay.	Mr. Lindon's Assay.	Panning at Townsville.	Iodine Test.
7, C. and C.	Gold and silver traces	...	No prospect	Gold trace.
8, C. and C.	Silver ... 2 oz. 18 dwt. 19 gr. Gold trace	...	No prospect	No gold.
9, C. and C.	Gold and silver traces	...	No prospect	Gold trace.
14, E.B.L.	...	Gold trace	No prospect	Gold trace.
15, E.B.L.	...	Gold trace	No prospect	Gold trace.

TRENCH T1—U1.

This trench runs nearly north and south to the east of shaft S1. As it is mostly in the surface and partly tumbled in, it shows nothing but occasional quartzite and two or three patches of kaolin, which probably form portions of dykes.

TRENCH V1—W1.

This trench runs north-east on the southern slope of the Eastern Hill. At 124 links from V1 a reef of quartz, about 4 feet wide, runs north-west and south-east. It contains more limonite and less manganese than the lode in shaft S1. The greater part of the trench hardly cuts through the surface wash, and the walls are partly tumbled in. Where the rock is seen it is either quartzite or weathered shales.

TRENCH

Trench F2—G2.

This trench ("No. 1 Trench, Western Hill," in the Company's nomenclature) is driven in a north-westerly direction across the crown of the Western Hill to test the ground marked on Mr. Ranft's map as having yielded prospects of 25 oz. of gold to the ton. Trenches D2—C2 and A2—B2 have been driven with the same object.

Commencing at G2, the first 23 links show only surface. From 23 to 27 links quartzite rocks are seen. From 27 to 72 links (measured on the floor of the trench) is a mass of kaolin which rises at 30 degrees to the east, overlaid by a lode or reef extending (on the floor) from 72 to 105 links. The western side of the lode has a steep underlie to the west. We panned off samples of honeycombed ferruginous quartz from the bottom of the lode immediately above the kaolin at 56 links from G2, but found "no prospect." We next tried a sample of red ironstone 68 links from G2, midway between the top of the kaolin and a slickensided ferruginous face, with the like result. Another sample from 1 foot above the last (a flake of quartz and limonite beneath a slickensided surface) was panned off, and again we saw "no prospect." From another, 76 links from G2 (laminated quartz with limonite bands, crossed by slickensided faces), and another, 86 links from G2 (a manganese and quartz vein), we had the same results. The samples taken to Townsville yielded as follows:—No. 1 (51 links from G2)—in the dish "no prospect," with the iodine test a trace of gold. No. 2 (79 links from G2)—in the dish "no prospect," with the iodine test a trace of gold, Coane and Clarke's assay (10, C. and C.) gold and silver traces. No. 3 (97 links from G2)—in the dish "no prospect," with the iodine test a faint trace of gold, Coane and Clarke's assay (12, C. and C.) gold and silver traces. This lode is traceable on the surface up the spur to the next trench, D2—C2. From 105 to 141 links shattered ferruginous quartzites are met with. At 141 links is a kaolin dyke underlying at 50 degrees to the west. Thence to 147 links (on the floor) are shattered quartzites. Thence (on the floor) to near F2 is another mass of kaolin. Near its east end the kaolin has a dome-shaped top, and on the north side of the trench it is surmounted by shattered quartzites.

Trench D2—C2.

This trench (the Company's "No. 2 Trench, Western Hill") runs parallel with the last further up the hill. The first 72 links from D2 are occupied by shattered quartzites. Thence to 232 links the trench crosses the large lode seen in trench F2—G2. From 232 at least as far as 252 links is a soft decomposing massive felspathic rock probably representing the large kaolin dyke of trench F2—G2. From 252 links to C only surface wash is visible. From C the trench is carried for 60 links in the same line at a lower level, entirely through kaolin, except for a band of quartzite 1 foot in thickness.

A sample of the large lode taken 1 chain from D2 panned on the spot gave "no prospect." A sample (No. 2) from 121 links from D2, gave "no prospect" in the dish at Townsville and a trace of gold by the iodine test. A sample (No. 1) from 130 links gave in the dish on the spot and at Townsville "no prospect," with the iodine test a faint trace of gold, and by Coane and Clarke's assay (11, C. and C.) traces of gold and silver. A sample (No. 3) from 180 links, gave at Townsville "no prospect" in the dish, a trace of gold with the iodine test, and by Coane and Clarke's assay (13, C. and C.) traces of gold and silver. A sample from 210 links panned out on the spot gave "no prospect."

Trench A2—B2.

This trench (the Company's "No. 3 Trench, Western Hill") is paralled with the two trenches last referred to, but nearer the summit of the hill. It cuts the large lode seen in No. 1 and No. 2 trenches.

The first 48 links from A2 show only surface wash and broken quartzite. The lode extends from 48 to 112 links. From 112 to 124 links a kaolin dyke underlying to north-west under the lode. From 124 to 150 links another lode. From 150 links to B2 broken quartzite and surface wash. The load west of the kaolin is less mineralised than in the two trenches to the south-west. The load east of the kaolin is black, red, and yellow, with iron and manganese oxides. A sample from this lode, assayed by Coane and Clarke (14, C. and C.) gave traces of gold and silver, a trace of gold by the iodine test, but "no prospect" in the dish.

The lode seen in this trench can be traced to the summit of the hill by the outcrop of iron-stained boulders. From the hilltop a line of similar boulders can be traced north-westward nearly into trench L1—J1. It is possible that this may be the lode which is seen in trenches Nos. 1, 2, and 3, deflected from its original course, but more likely that two lodes cross at the summit of the hill.

Trench L1—J1.

This trench runs from north-east to south-west across the northern spur of the Eastern Hill.

Only surface wash is seen for the first 74 links from L1. Thence to 1 chain is the débris of a soft felspathic rock, probably a felstone dyke. Thence to 185 links shattered quartzite in thin beds.

At 185 links is the edge of a lode which underlies to west-south-west at a high angle. This lode is dark and flinty but not very much mineralised. It extends to 218 links from L1, where it lies at a high angle (close to K1) on soft kaolin. The kaolin extends to 66 links from K1 and is followed by 4 links of weathered felstone. A lode, having very much the character of that in Nos. 1, 2, and 3 trenches, occupies the trench from 70 to 121 links from K1. A sample of it gave at Townsville two very fine "colours" of gold in the dish, a trace of gold by the iodine test, and traces of gold and silver by Coane and Clarke's assay (15, C. and C.).

The quartzite country rock, generally in thin, nearly vertical, beds, and invariably containing a small percentage of pyrites, appears to have been taken for reef quartz by some of the managers and others who have had the direction of the operations at Taranganba. Rocks of very much the same character occupy hundreds, and perhaps thousands, of square miles in the immediate neighbourhood of Taranganba, at Mount Morgan, Mount Albion, and elsewhere in the Colony. Should the Taranganba quartzites prove to contain payable gold throughout, the capital value of many of the "waste lands of the

Crown"

Crown" would be enormously increased. For obvious reasons, I have never examined any similar area for gold in such minute detail. The Taranganba quartzites seldom fail to give a reaction for gold by the delicate iodine test, although prospecting with the pan (after the material has been ground on a "bucking-plate" and passed through a fine sieve) rarely detects even the finest "colour," and even an assay may fail to detect a trace of gold. That the fine gold present in the quartzites is mainly confined to the pyrites was proved by numerous experiments in which I concentrated the pyrites in the dish and failed to obtain the gold reaction in the quartzose remainder of the sample. The undoubted presence of gold in the quartzites may possibly justify the assertion that the hillocks of Taranganba are in a certain sense "mountains of gold," but the gold bears a proportion to the stone which is very far indeed from being payable. In the same sense sea-water is auriferous.*

With a country rock containing gold even in an infinitesimally small proportion, the hope may always be legitimately indulged that the precious metal will prove to be sufficiently concentrated in reefs or lodes to pay for its extraction. The presence in the Taranganba estate of many leaders, reefs, and lodes (some of them of large size and intimately associated with dykes of igneous origin) surrounded by an auriferous country rock, very properly led to prospecting, but it is very much to be regretted that the prospecting was not devoted exclusively to the reefs and lodes. The accumulation of rubbish such as that which has been excavated from the "big cutting" was a mere waste of time and money, and to represent such stuff as being worth 10 oz. of gold per ton, or even as being worth treating, was in the highest degree misleading.

The work done to prove the value of the reefs and lodes is trifling in comparison with that expended in trenching and the raising of worthless "stone." What I was able to see of them (and I could do no more without settling down to work the mine for the owners) was as follows:—

The only distinctly payable assay out of the 34 executed by Mr. E. B. Lindon and Messrs. Coane and Clarke was one which showed 1 oz. 14 dwt. 7 gr. of gold and 16 dwt. 8 gr. of silver to the ton, from a small vein at the mouth of the tunnel opening out of trench M—O. The fact that one dish of this stone showed no gold, and another only a single fine "colour," argues the extreme fineness of the gold. Another vein (1) in trench M—O assayed for 4 dwt. 21 gr. of gold and 8 dwt. 4 gr. of silver to the ton. An assay of a sample of the large lode in trench Q—S gave 4 dwt. 21 gr. of gold and 5 dwt. of silver to the ton. Lastly, a sample of quartzite from the "big cutting" gave 4 dwt. 21 gr. of gold and 5 dwt. 14 gr. of silver to the ton. Ores giving 4 dwt. 21 gr. of gold to the ton might pay under certain circumstances. The large lode in trenches Q—S and U—V, should it prove to yield steadily at this rate throughout, might pay with careful and economical management, but it must be borne in mind that this lode is not cut in the tunnel W—Q, and appears to pinch out to the north at R, and is not cut at all in trench Z—B1. The quartz vein (1), in trench M—O, which is 3 feet wide, might also pay if uniform in quality, but from its appearance I should say that it is not so. The assay of 4 dwt. 21 gr. of gold from one of the samples from the "big cutting" can lead to nothing, as there is no reef or other indication to follow. The other lodes and reefs, though some of them are very large, gave me nothing like payable results.

I do not doubt that the directors or their employés may be able, from familiarity with the ground and the large number of assays and "prospects" which they have made, to lay their hands on exceptionally rich specimens, but I am certain that if the various reefs and lodes exposed in the trenches and tunnels had been even moderately rich they would have yielded better results to me. I selected the specimens taken for trial very carefully from the most highly mineralised and best-looking portions of the reefs and lodes. Had these proved conspicuously rich I should, of course, have next tried to average the less promising portions. It is quite possible that something may yet be found on the ground good enough to cover the cost of working, but it is clear to my mind that nothing has yet been opened out which is at all likely to pay dividends on the amount referred to in the pamphlet, "The Celebrated Taranganba Gold Mine," as the capital of the company.

ROBERT L. JACK.

Geological Survey Office,
Townsville, 18th May, 1889.

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* *Sonstadt. Chemical News*, October, 1872.

APPENDIX A.

APPENDIX A.

TABLE showing RESULTS from TARANGANBA SPECIMENS.

Locality and Marks.	Assay No.	Assay by Coane and Clarke.	Assay by E. B. Lindon.	Panning at Taranganba.	Panning at Townsville.	Iodine Test.
Trench M-O ... ... Thin filmy veins in bedding planes of black quartzite, 21 links W. of M.	...	...	...	No prospect.		
Trench M-O ... ... North side of trench, immediately west of Kaolin dyke.	...	...	...	No prospect.		
Trench M-O ... ... Vein (1).	...	...	...	No prospect.		
Ditto	1 C & C	Oz. dwt. gr. Gold 0 4 21 Silver 0 8 4	...	...	No prospect	Gold trace.
Trench M-O ... ... Vein (2).	...	...	...	No prospect.		
Ditto	1 EBL	...	No gold	...	No prospect	Gold trace.
Trench M-O ... ... Vein (3).	...	...	...	No prospect.		
Ditto	2 EBL	...	Gold trace	...	No prospect	Gold trace.
Trench M-O (4) ... ... Quartzite 2 chs. 30 lks. west of M.	...	...	...	No prospect.		
Trench M-O ... ... Black vein at mouth of short tunnel	...	...	...	No prospect.		
Ditto	2 C & C	Oz. dwt. gr. Gold 1 14 7 Silver 0 16 8	...	...	One fine "colour" of gold	Gold.
Trench M-O ... ... Average sample from quartzite country rock	...	...	...	No prospect.		
Trench Q-S ... ... Lode near S., mixed sample	...	...	...	Gold—a small prospect.		
Ditto	3 EDL	...	No gold	...	No prospect	Gold, faint trace.
Trench U-V ... ... (a) Lode 15 links from V	...	...	...	Gold—a small prospect.		
Ditto	3 C & C	Oz. dwt. gr. Gold 0 4 21 Silver 0 5 0	...	...	No prospect	Gold trace.
Trench U-V ... ... (b) Lode 33 links from V	...	...	...	No prospect.		
Ditto	4 EBL	...	Gold trace	...	No prospect	Gold trace.
Trench R-T ... ... Lode 78 links from R ...	...	...	...	No prospect.		
Big Cutting X-A1 ... ... Filmy veins on east side	...	...	...	...	No prospect.	
Big Cutting ... ... (1) East end of face	...	...	...	...	No prospect.	
Ditto	4 C & C	Oz. dwt. gr. Gold 0 4 21 Silver 0 5 14	...	...	One fine "colour" of gold	Gold trace.
Big Cutting ... ... (2) 5ft. from east end of face	5 EBL	...	Gold trace	...	No prospect	Gold trace.
Big Cutting ... ... (3) 10ft. from east end of face	...	...	...	...	No prospect	Gold trace.
Big Cutting ... ... (4) 15ft. from east end of face	5 C & C	Gold and silver traces	...	...	No prospect	Gold trace.
Big Cutting ... ... (5) 20ft. from east end of face	6 EBL	...	No gold	...	No prospect	Gold trace.
Big Cutting ... ... (6) 25ft. from east end of face	...	...	...	...	No prospect	Gold trace.
Big Cutting ... ... (7) West end of face	7 EBL	...	Gold trace	No prospect	No prospect	Gold trace.
Big Cutting ... ... 9ft. from east end of face	...	...	...	No prospect.		
Big Cutting ... ... 16ft. from east end of face	...	...	...	No prospect.		
Big Cutting ... ... 19ft. from east end of face	...	...	...	No prospect.		
Big Cutting ... ... 24ft. from east end of face	...	...	...	No prospect.		
Big Cutting ... ... Upper end Limonite vein near A1	...	...	...	No prospect.		

APPENDIX A.—*continued.*

TABLE showing RESULTS from TARANGANBA SPECIMENS.

Locality and Marks.	Assay No.	Assay by Coane and Clarke.	Assay by E. B. Lindon.	Panning at Taranganba.	Panning at Townsville.	Iodine Test.
Trench Z-B1 ... ... Quartz Reef, 36 links from B1	...	...	...	No prospect.		
Trench Z-B1 ... ... (1) Lode in trench extending from 74 links to 143 links from B1; 5 links from eastern edge of lode	8 EBL	...	No gold	No prospect	No prospect	No gold.
Trench Z-B1 ... ... (2) Same lode—Samples from likeliest places all over the lode	9 EBL	...	Gold traces	No prospect	No prospect	No gold.
Trench Z-B1 ... ... (3) Reef at 2 chains 25 links from B1	10 EBL	...	Gold trace	No prospect	No prospect	Gold, a faint trace.
Trench Z-B1 ... ... Quartzite near Z	...	...	...	No prospect.		
Trench E1-H1 ... ... At D1	...	...	...	No prospect.		
Trench E1-H1 ... ... (1) 14 links west of D1	11 EBL	...	Gold trace	...	No prospect	Gold trace.
Trench E1-H1 ... ... (2) 61 links west of D1	12 EBL	...	Gold trace	...	No prospect	Gold trace.
Trench E1-H1 ... ... 72 links east of M1	...	...	...	No prospect.		
Trench E1-H1 ... ... (3) Quartzite from 1 chain 15 links east of M1	...	...	...	...	No prospect	Gold trace.
Trench F1-G1 ... ... (1) 14 links east of F1	6 C & C	Gold and silver traces	...	...	No prospect	Gold trace.
Trench F1-G1 ... ... (2) Quartzite 1 yard west of Main dyke	...	...	...	...	No prospect	Gold trace,
Trench F1-G1 ... ... (3) vein 90 links from G1	13 EBL	...	No gold	No prospect	No prospect	Gold trace.
Shaft S1 ... ... Manganiferous ore 3 feet from surface	...	...	...	No prospect.		
Shaft S1 ... ... 20 pieces of manganiferous ore from west side of shaft	...	...	...	No prospect.		
Shaft S1 ... ... Quartzose and ferruginous fragments from sides	...	...	...	No prospect.		
Shaft S1 ... ... (From heap)	14 EBL	...	Gold trace	...	No prospect	Gold trace.
Shaft S1 ... ... (From heap)	15 EBL	...	Gold trace	...	No prospect	Gold trace.
Shaft S1 ... ... (From heap)	7 C & C	Gold and silver traces	...	...	No prospect	Gold trace.
Shaft S1 ... ... (From heap)	8 C & C	Oz. dwt. gr. Silver 2 18 19 Gold trace	...	...	No prospect	No gold.
Shaft S1 ... ... (From heap)	9 C & C	Gold and silver traces	...	...	No prospect	Gold trace.
Trench F2-G2 ... ... Bottom of lode overlying Kaolin, 56 links from G2	...	...	...	No prospect.		
Trench F2-G2 ... ... Lode 68 links from G2	...	...	...	No prospect.		
Trench F2-G2 ... ... Lode 1 foot above last sample	...	...	...	No prospect.		
Trench F2-G2 ... ... 76 links from G2	...	...	...	No prospect.		
Trench F2-G2 ... ... 86 links from G2 (quartz and manganese vein)	...	...	...	No prospect.		
Trench F2-G2 ... ... (1) 51 links from G2	...	...	...	...	No prospect	Gold trace.
Trench F2-G2 ... ... (2) 79 links from G2	10 C&C	Gold and silver traces	...	...	No prospect	Gold trace.
Trench F2-G2 ... ... (3) 97 links from G2	12 C&C	Gold and silver traces	...	...	No prospect	Gold, faint trace.
Trench D2-C2 ... ... 1 chain from D2	...	...	...	No prospect.		
Trench D2-C2 ... ... (1) 1 chain 30 links from D2	11 C&C	Gold and silver traces	...	No prospect	No prospect	Gold, faint trace.
Trench D2-C2 ... ... (2) 1 chain 21 links from D2	...	...	...	...	No prospect	Gold trace.

APPENDIX A.—*continued.*

TABLE showing RESULTS from TARANGANBA SPECIMENS.

Locality and Marks.	Assay No.	Assay by Coanes and Clarke.	Assay by E. B. Lindon.	Panning at Taranganba.	Panning at Townsville	Iodine Test.
Trench D2-C2 ... ... (3) 1 chain 80 links from D2	13 C&C	Gold and silver traces	...	...	No prospect	Gold trace.
Trench D2-C2 ... ... 2 chains 10 links from D2	...	...	...	No prospect.		
Trench A2-B ... ... Reef east of Kaolin Dyke	14 C&C	Gold and silver traces	...	...	No prospect	Gold trace.
Trench L1-J1 ... ... Reef 1 chain 21 links from K1	15 C&C	Gold and silver traces	...	...	Gold, 2 very fine "colours"	Gold trace.
Tunnel W-Q ... ... (1) Black vein at H2	16 C&C	Gold and silver traces	...	...	No prospect	Gold trace.
Tunnel W-Q ... ... (2) Reef at face of south drive from shaft	17 C&C	Gold and silver traces	...	...	No prospect	Gold trace.
Tunnel W-Q ... ... (3) Chips broken across face of north drive from shaft	16 EBL	...	No gold.			
Tunnel W-Q ... ... (4) 38 yards from mouth	17 EBL	...	No gold ...	...	No prospect	Gold, faint trace.

Price 1s.]

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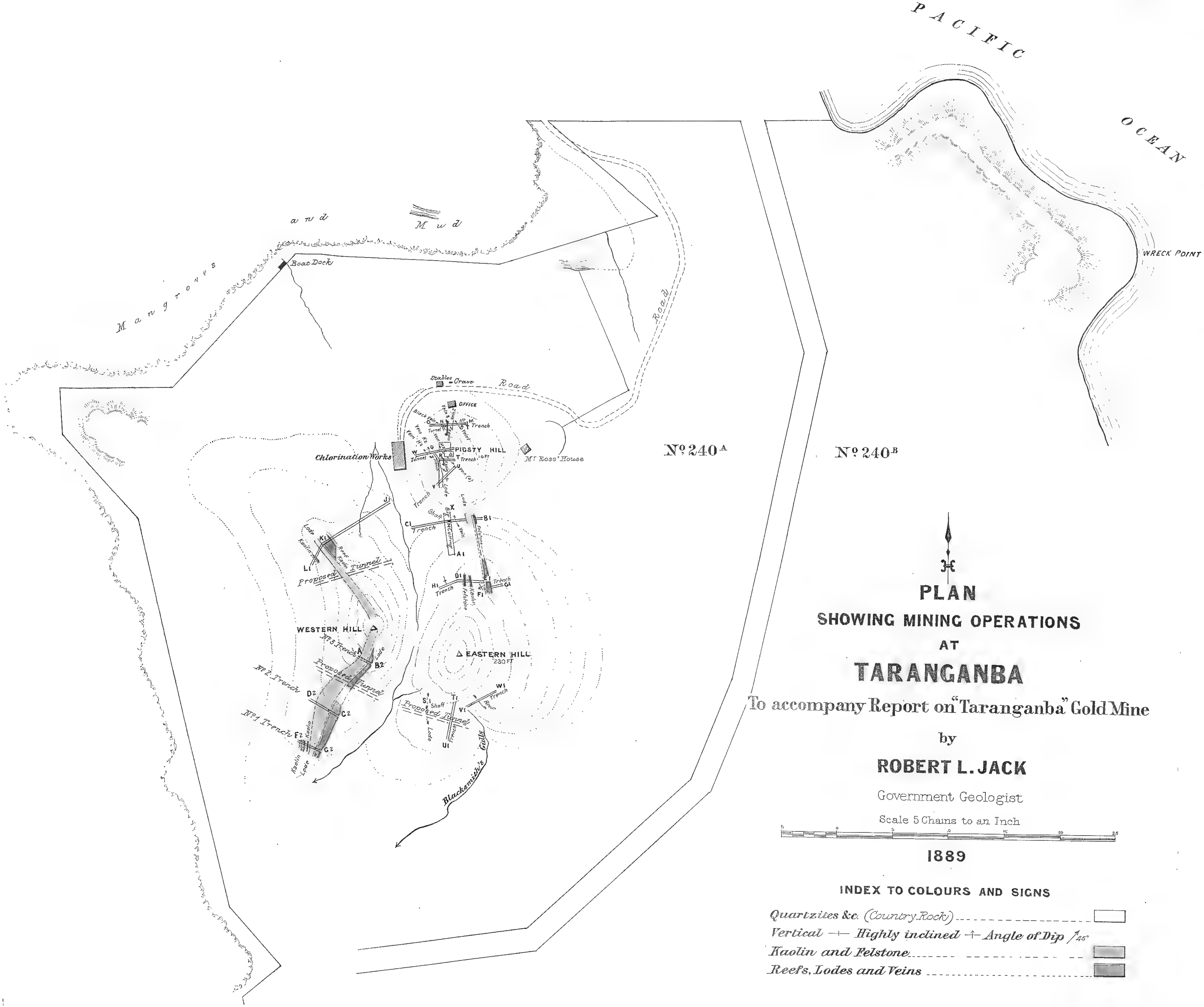


PACIFIC
OCEAN
WRECK POINT
Mangroves and Mud
Boat Dock
Road
Stables
Crave
OFFICE
PIGSTY HILL
Chlorination Works
Mr. Ross' House
Nº 240 A
Nº 240 B
Trench
Tunnel
Shaft
Lode
Kaolin
Reef
Vein
Proposed Tunnel
WESTERN HILL
EASTERN HILL
230 FT
Nº 3 Trench
Nº 2 Trench
Nº 1 Trench
Blacksmith's Gully
PLAN
SHOWING MINING OPERATIONS
AT
TARANGANBA
To accompany Report on "Taranganba" Gold Mine
by
ROBERT L. JACK
Government Geologist
Scale 5 Chains to an Inch
1889
INDEX TO COLOURS AND SIGNS
Quartzites &c. (Country Rock)
Vertical Highly inclined Angle of Dip 45°
Kaolin and Felstone
Reefs, Lodes and Veins

51

1889.

QUEENSLAND.

ALBERT AND LOGAN DISTRICT.

(REPORT BY WILLIAM H. RANDS, ASSISTANT GOVERNMENT GEOLOGIST.)

Presented to both Houses of Parliament by Command.

In the early part of 1887 I inspected and reported upon the part of this District situated in the vicinity of Beenleigh and the Logan Village.

In that report I described, in some detail, the schist formation and reefs in the neighbourhood of Beenleigh, and the coal-bearing rocks around the Logan Village.

During my recent visit I traversed the country lying to the south of the above down to the Macpherson Range (the southern boundary of the Colony), and as far west as the Logan River.

A geological sketch map accompanies this Report. This map is based on the two-mile lithographic plan of the district.

The following are the formations met with in this area:—

1. Recent Alluvium.
2. Desert Sandstone (Upper Cretaceous).
3. Basaltic Rocks.
4. Older Volcanic.
5. Ipswich Beds, coal-bearing (Jurassic).
6. Metamorphic Schists (probably Silurian).

Recent Alluvium.

Although these deposits occupy a comparatively small area, they are of some considerable importance, as they form the chief agricultural land of the district. The alluvial deposits fringe the banks of the rivers and creeks.

Towards the heads of the Logan and Albert Rivers and Nerang Creek there are extensive alluvial black soil flats, the soil of which has been derived from the surrounding basaltic country; they form very fine country either for agricultural or pastoral purposes.

The Desert Sandstone.

This formation, which at one time covered the greater part of Queensland, is met with towards the heads of Nerang Creek, near Mr. Nixon's selections.

It forms the summit of the ranges between Mudgeeraba and Nerang Creek, between Nerang Creek and Nixon's Creek, and between Nixon's Creek and Back Creek.

The thickness of this deposit is about 150 feet, some distance down the ranges; and increases to 300 feet or 400 feet towards the heads of the creeks.

It stands out in bold perpendicular cliffs, full of small hollows or caves.

At its base the deposit is a conglomerate, composed of rounded pebbles and boulders of basalt, similar to that met with in the neighbourhood. Some of these boulders are over 15 inches in diameter. Higher up the rock consists of a granular siliceous sandstone, with thin layers of coarse quartz pebbles.

The formation here certainly appears to be an ordinary sedimentary deposit, and not of volcanic origin, as suggested by the Rev. J. E. Tenison-Woods in a paper read lately before the Royal Society of New South Wales.

The age of the desert sandstone has caused much discussion. It has generally been classed as a Tertiary deposit. Mr. Norman Taylor found marine fossils of cretaceous types on the Endeavour River, and, quite lately, fossils have been found in it near Croydon, which have been determined by Mr. Robert Etheridge, junr., to be of upper cretaceous types, many of the species being identical with those found in the cretaceous beds of Maryborough. Mr. Jack, in his map of the colony, has called it upper cretaceous.

Basalt.

The next formation in order of age is the basalt. The date of the outflow of this basalt is most certainly anterior to that of the deposition of the desert sandstone; for up Nerang Creek, near Mr. Nixon's, there is a good section showing the desert sandstone overlying the basalt. (Fig. No. 1).

Assuming that the desert sandstone is upper cretaceous, the outflow of basalt must have taken place in Mesozoic times, and not in the latter part of the Tertiary period, to which date it has hitherto been ascribed.

It

C. A. 5—1889.

It is probable that nearly the whole of the south-eastern portion of Queensland was covered with this basalt, as it is found capping nearly all the higher ground of the district, right away from the plains of the Darling Downs, near Laidley, Grandchester, Ipswich, Waterford, Mount Tambourine, on the dividing ranges between the Logan, Albert, and Coomera Rivers, and Nerang, Mudgeeraba, Tallebudgera, and Corrumbin Creeks. It is also met with at Burleigh Heads, Corrumbin Heads, Point Danger, and on the Macpherson Range.

The basalt is generally full of olivine crystals. On Burleigh Heads, and on the eastern fall of Mount Tambourine, it has assumed the columnar form. The hexagonal pillars are often as much as 20 feet in length, and 3 to 4 feet in diameter.

The basalt is amygdaloidal on its upper surface. On the Macpherson Range, at the head of Tallebudgera Creek, there are large patches of obsidian and pitchstone in the basalt.

The basalt on the sides of the ranges is generally covered with a thick pine scrub.

Older Volcanic.

In two cuttings on the railway between Logan Village and Beaudesert, near Walton Station, in selections Nos. 80 and 114, belonging to Mr. William Everdell, a volcanic rock occurs in the coal measures.

The rock is a trachyte, containing beautifully developed crystals of sanidine felspar.

The rock has a spheroidal structure.

In the cutting close to Walton Station it appears to have come up through the coal measures, and to have overflown a portion of them. (*Fig. No. 2.*)

About a mile west of Walton Station, in Mr. J. Beal's selection, No. 122, the same rock (very much decomposed) crops out on either side of a small ridge which runs in a north-easterly direction. On ascending this ridge from the north-west side a considerable thickness of trachyte is met with in the bed of the gullies. Immediately above it is a bed of sandstone, then fine fissile carbonaceous shales, and above that again, on the top of the ridge, is a hardened siliceous sandstone. The same succession of rocks is met with on descending the ridge on the opposite side. The sandstone immediately above the trachyte is not hardened or altered, and the trachyte appears to be interbedded with the Ipswich beds.

This is the only locality in the district that I met with this rock.

The Ipswich Beds (Jurassic).

The boundary between the Ipswich beds and the schists runs in a north-north-westerly direction from the heads of Nerang Creek to Mount Tambourine; it passes under the basalt of that mountain, and then continues in the same direction, running between Sandy and Cedar Creeks, and crossing the Albert River about a mile above its junction with Cedar Creek. It continues on in the same direction for about six miles, and then bends to the north, crossing the railway line and the Logan River near the village of Waterford. From thence it runs in a north-westerly direction to Kingston Railway Station, and then in a north-easterly direction to Mount Cotton, from which place it runs in a south-easterly direction to Alberton and Ageston.

The beds consist of a series of sandstones, shales, clays, with seams of coal. The beds dip generally at a low angle; the direction and amount of dip in various places is shown on the map.

At Ageston the country is covered with alluvial deposits; coal was met with, below the alluvium, in a borehole on Mr. W. H. Couldery's property, in selection No. 2.

In my report on the Beenleigh district, 1887, I described these beds, and the outcrops of coal that occur from Tambourine Mountain, as far north as Shailer's selection, No. 261.

Hearing that Mr. Watts had opened up another seem of coal, I revisited his selection, No. 11.

A drive 16 feet long has been put in on a seam of coal, which lies immediately beneath the freestone mentioned in my last report.

The section seen here is:—

	Feet.	Inches.
Freestone ... ... about	50	0
Black carbonaceous shale, with streaks of coal ...	0	4
Light yellowish clay ...	0	6
Dark brown laminated shale, with coal and sandstone ...	1	0
Coal, with a thin streak of clay ...	0	$5\frac{1}{2}$
Clay-band ...	0	1
Coal ...	0	$4\frac{1}{2}$
Clay-band ...	0	1
Coal ...	0	$2\frac{1}{2}$
Clay-band ...	0	3
Coal ...	1	0
Dark hard-band ...	0	2
Coal ...	0	8
Thin laminated sandstone ...	0	6
Coaly shale ...		

The seam is, therefore, 3 feet $3\frac{1}{2}$ inches thick, including 7 inches of bands. Unless these bands, which are distributed throughout the seam, thin out, the coal will be of no commercial value.

The dip of the strata here is south-south-west at 8 degrees.

The coal is situated at the head of a gully about 100 yards north-west of the shaft mentioned in my previous report.

The following is a proximate analysis of this coal:—

	Per cent.
Moisture ...	2·2
Volatile hydrocarbons ...	22·8
Fixed carbon ...	51·0
Ash ...	24·0
	100·0

The

The coal cakes well on coking. The ash is light-grey in colour. The coke was much swollen up, soft, and black coloured. The coal is laminated and friable.

The analysis of the coal from the shaft was :—

	Per cent.
Moisture	1·32
Volatile hydrocarbons	19·70
Fixed carbon	47·37
Ash	31·61
	100·00

The coke was hard and compact, and the ash of a slightly reddish-grey colour.

The high percentage of ash is probably due to the samples, in both cases, being taken from close to the surface.

The freestone overlying the coal is of a good white colour, medium in grain. It lies in beds averaging about 4 feet in thickness. Some of the layers are too laminated to make a good building stone, but others are massive and hard, and would make a good facing stone, though it is perhaps too coarse for fine mouldings.

Stone from this ridge, which runs across to the Logan, was used for building a chimney in the Logan Village about twenty-three years ago. The stone has withstood the weathering action of the atmosphere well.

A borehole was put down, on the Timber Reserve about two miles north of the Logan Village, to a depth of 350 feet. After passing through the Ipswich beds, the schists were struck in the bottom of the bore. No thick coal was met with.

In the cuttings on the railway between the Logan Village and Jimboomba nothing but sandstones and shales is visible. Close to Jimboomba the sandstone is thick-bedded and nodular.

In Goertz's selection, No. 20, about three miles south of Jimboomba, I was shown a bed of highly carbonaceous shale, containing streaks of coal which had been mistaken for a seam of coal.

The country in the neighbourhood of Tambourine consists almost entirely of brown sandstones.

From Tambourine up to Lahey's Mill, on Cunungra Creek, nothing but sandstone ridges and black soil flats are traversed. The higher ridges on either side of the creek are capped with basalt; while six miles above the mill the country is almost entirely of basalt.

Mr. Paine accompanied me over a low gap in the Darlington Range, where there is a break in the basalt, on to the heads of the Coomera River. The country was all sandstone.

On Back Pine Creek there is a section of blue and black carbonaceous shale, with streaks of coal, overlying a hardened sandstone, and dipping south-west at 15 degrees.

Close to Pine Creek, near selection 31, there is a hill called Meerschaum Mountain, from the fact that a very light white material, somewhat resembling that mineral, can be picked up on its sides. I have not seen this substance *in situ*.

This substance is an infusorial earth. Mr. W. A. Dixon, of Sydney, gives the following analysis of it :—

	Per cent.
Moisture and traces of organic matter	10·31
Oxide of iron and traces of alumina	0·59
Lime	traces
Silica	89·10
	100·00

Mr. Dixon says that under the microscope the silica is almost entirely composed of the frustules of diatomes—probably *Melosia arenaria*. I confirmed Mr. Dixon's remarks as far as the microscopical examination went.

Returning to Tambourine, I next visited Mr. G. A. Ball's selection (No. 71) on Flagstone Creek, where a seam of coal, about 2 feet 6 inches thick, crops out in the banks of the creek. A section across the seam shows :—

	Feet.	Inches.
Coal	0	8½
Coaly shale	0	2
Coal	0	10
Clay band	0	1
Coal	0	10
Coarse grey sandstone	0	0
	2	7½

A small fault running north 15 degrees west, across the creek, displaces the seam about 2 feet. The coal dips south 30 degrees west at 12 degrees.

The following is a proximate analysis of a sample of the coal taken from the cleanest part of the seam :—

	Per cent.
Moisture	8·1
Volatile hydrocarbons	38·7
Fixed carbon	50·7
Ash	2·5
	100·0

The coal is a bright non-caking coal; the ash is white.

The small range between Flagstone Creek and Beaudesert, known as Birnam Range, is of a hard silicified sandstone. On the western fall of this range a great thickness of black and blue shales is visible in the gullies in Mr. W. T. Walker's selection (No. 94).

In Mr. Rafter's selection (No. 63) there is a ridge of sandstone running in a northerly direction. The lower part of this sandstone contains a large percentage of iron. In the upper part, some of the beds are very soft. I noticed one bed, about 9 feet thick, which was a good hard stone, and had apparently withstood weathering action well. I do not think that any of it is of sufficiently good character to pay for carriage as a building stone.

I was

I was afterwards informed that Mr. Jennings had opened up a small quarry in his selection to the north of Rafter's, on the same ridge of sandstone, but unless it is of a very superior quality it would not compete with the building stones at present available for Brisbane.

The sandstone dips to the east at 24 degrees.

Below the sandstone, and a little higher up the gully, a seam of coal, with the same dip, and 1 foot 7 inches in thickness, crops out in the bank.

It is a good, bright, non-caking coal, without any bands; but it has too high an angle of dip, and is not thick enough to pay to work.

The section in the gully shows :—

	Feet.	Inches.
Sandstone	0	0
White clay	0	0
Coal	1	7
Fireclay	0	1½
Laminated sandstone	0	0

Approximate analysis of this coal gives :—

	Per cent.
Moisture...	4·3
Volatile hydrocarbons	13·5
Fixed carbon	71·1
Ash	11·1
	100·0

The ash was of a dark grey colour.

A seam of coal crops out in a gully, in selection No. 137, belonging to Mr. Brayford, about 1½ miles north of Beaudesert. The section in the gully is :—

	Feet.	Inches.
Fireclay	0	0
Black shale with streaks of coal	0	6½
Fireclay	0	4
Black shale with streaks of coal	0	11
Fireclay	0	3
Coal	0	3
Fireclay	0	3
Brown shale	0	5½
Bright clean coal	1	4
Fireclay	0	9
Coal	0	6½

This is one of the best looking coals I saw in the district.

The dip of the coal is west 10 degrees north at 10 degrees.

I append analysis of two samples of this coal, one taken from the outcrop in the gully, and analysed by Mr. Joseph Fletcher, the other from a shaft in Mr. John Waters' selection (No. 120), and analysed by myself :—

Sample.	Sample from outcrop. Per cent.	Sample from shaft. Per cent.
Moisture	8·0	not determined
Volatile hydrocarbons	34·0	44·0 (includes moisture)
Fixed carbon	33·0	47·3
Ash	25·2	8·7
	100·0	100·0

The ash was white. The coal is hard, and has a specific gravity of 1·41. It resembles a cannel coal, and burns freely.

The shaft in Mr. John Waters' selection was filled in, but I was informed that the coal was much thicker there.

Another seam crops out about 100 yards higher up the gully. This is very impure coal; it is more of a coaly shale.

From Beaudesert I went up the Logan and Palen Creek to within 3 or 4 miles of Mount Stanley, about 30 miles south of Beaudesert.

The Ipswich beds extended all the way up. I saw no seams of coal. In Mr. Byrne's selection, on Palen Creek, I was shown a bed of black carbonaceous shale, about 15 inches in thickness, which had been mistaken for coal.

Seams of coal have been reported to exist in Christmas and Widgee Creeks, but as I could get no definite information regarding them I did not visit that part of the country.

Nothing, it will be observed, has been attempted in the way of trying any of these seams away from their outcrops; the seams are, in no case, of any great thickness, but the analyses of some of the coals show them to be of a fair quality, and I think it would repay the owners of the properties to test them at a shallow depth away from the outcrops.

I believe that Mr. Downman has done nothing at present to verify, by means of a shaft, the correctness of the results obtained in a borehole put down by Mr. Falconer, a section of which I gave in my previous report.

The Schists.

The schists are the oldest rocks in the district. No fossil remains have been found in them from which their age can be determined; they belong, however, to the Brisbane series, which have been regarded as Silurian.

The schists occupy the area east of the Ipswich beds to the coast, from a point about ten miles north of Beenleigh down to the Macpherson Range. The whole of this area is very poor country and badly grassed.

I first

I first visited the Mudgeeraba and Tallebudgera districts. The rocks here consist of clay and quartzose or siliceous schists, with an occasional band of aluminous slate, and of a fine grit or conglomerate containing pebbles of clay schist. Small quartz veins exist throughout the schists, their dip coinciding with that of the schists. At the Currumbin Heads and at the Nobbys, about 1½ miles north of Beenleigh, the schists are interlaced by a network of quartz veinlets. Iron pyrites is usually present in the schists.

The general dip of the rocks is between west and south-south-west at an average angle of about 45 degrees.

Mr. Fowler, who acted as my guide through this neighbourhood, was unable to show me any reef or lode of any description; he has spent some considerable time in prospecting, and he told me that the only gold he had seen was in a small pebble in the bed of Mudgeeraba Creek on his selection, 12A; he also informed me that all prospecting for alluvial gold in the gullies has been an entire failure.

An assay by Mr. Staiger of a dark-coloured siliceous slate, in Mr. Anderson's selection (No. 34), on Mudgeeraba Creek, gave traces of both gold and silver. I tried some pieces of this rock and found only one small colour of gold.

Along the beach from the mouth of Nerang Creek to the Tweed Heads there are layers of black sand, containing magnetic iron ore, which alternate with the ordinary sea sand. These layers are from 1 to 6 inches thick, and contain gold.

At the mouth of Currumbin Creek, where the sand has been dug into and worked, several such layers are seen about 1 foot apart. The different layers vary greatly in the amount of gold they contain; from one, at a depth of 16 feet, two men are said to have taken out 4 oz. in a week, but the water gave a good deal of trouble It would appear most probable that the gold, which is very fine, came from some of the siliceous rocks up the creeks, such as that in Mr. Anderson's selection mentioned above, and was redistributed by the action of the waves. The action of the water on the sands would be to collect the gold and the heavy magnetic iron sand together at the bottom, while the lighter sea sand would form layers on the top.

Two men were at work here at the time of my visit. Their method of extracting the gold was crude and simple; it consisted in shovelling the black sand into a box and washing it down, by means of a hand pump, over a few amalgamated copper plates. I think a great deal of the gold must be lost with such rude appliances, as the flow of water over the plates would be very uneven.

It is quite possible that these deposits may be made to pay, as similar beach deposits have been worked with profit in Klamath County, California; and also near Charleston, in New Zealand.

In the neighbourhood of Southport the country consists chiefly of clay schists dipping west-north-west at 45 degrees. In Coombabah paddock there are a number of small segregation veins in the schists, but they contain no gold.

I was informed that gold had been found in the quartz gravel of the Gravel Reserve, one and a-half miles west of Southport This quartz has been derived from the small veinlets in the schists. The quartz in the Reserve is about 6 inches thick and is lying on the surface; it is not of a character likely to contain gold, though occasional specks may have been seen. In Southport, I was shown a piece of qnartz containing rich gold which was reported to have been picked up here; both the quartz and the gold, however, resembled too much that from Gympie to permit one to put any faith in the report.

In passing up Nerang Creek schists occur for the first six miles or so above Nerang, then for five miles is an altered grit and conglomerate similar to that met with on Mudgeeraba Creek. Beyond that siliceous schists occur again up to Mr. Nixon's selection (No. 6), when the Ipswich beds come in. Quartz veins carrying traces of gold occur in Selection No. 28, not far from the mill.

About six miles west-south-west of Nerang, near Selection No. 20, a quartz reef occurs running north 20 degrees west and underlying west 20 degrees south at 55 degrees. It is from 18 inches to 24 inches in width at the surface. The quartz is of a hard, white, crystalline character, and is cellular in parts. It is situated on the eastern fall of a steep ridge which is covered with dense scrub. The country is a hard, dark, siliceous schist, almost a quartzite. Mr. Staiger reported 8 dwts. per ton of gold on assay; I took several pieces of quartz from the reef as a sample, but could not find a trace of gold in them.

From Nerang I proceeded to the Coomera River, about six miles above the township of Coomera. On the road near Birley's selection (No. 17), there is a large reef of white quartz of the nature of that called by the miners "buck quartz." It is running in a north-westerly direction.

In Ferguson's selection (No. 26), on the Coomera River, there is a belt of hard siliceous schist in a soft clay schist, which has been mistaken for a quartz reef.

In Carrington's selection (No. 32) a shaft has been sunk to a depth of 26 feet on a small vein or pocket of quartz. The vein is about 7 inches in width on the northern side of the sharft, while on the south side there is no trace of it. Above the quartz there is 2 feet in thickness of a siliceous schist, the faces of which are covered with graphite, which, according to Staiger, yield 7 dwts. of gold per ton. The quartz of the vein assayed by the same assayer yielded from 7 dwts. to 10 dwts. 3 grains of gold per ton. The schists are very pyritous.

A great amount of work has been done on Mr. Jamieson's selection (No. 36) on Wonga Wallen Creek.

The rocks cropping out in the gully consist of a hard quartzose laminated schist. A reef crops out in this gully which consists of a hard quartz containing the oxides of iron and manganese. No work has been done on this reef, but a shaft has been sunk to a depth of 40 feet;—this shaft would be below the line of outcrop of the reef. The shaft was full of water. From specimens on the mullock heap it had evidently passed through a cellular quartz containing brown hæmatite. This quartz is said to have assayed 7 dwts. of gold per ton. In a second shaft nothing but schist with its faces coated with graphite was to be seen. Other work has been carried on on this property, but apparently without any sufficient reason.

From Coomera I went to Pimpama. The schists in this neighbourhood are in places very calcareous; in some of the gullies in Mr. Harding's selection there is a deposit of lime which has been dissolved out of the schists.

I revisited

I revisited Mr. Beaton's selection (No. 68), where work has been carried on since my former visit. A tunnel, 180 feet in length, has been driven into the hill to test the reef, which I mentioned in my former report. The reef is running N. 25 degrees W. For the first 80 feet the tunnel runs in a direction of N. 15 degrees W., or nearly parallel with the reef; at that distance a reef or "pocket" of quartz, mixed with a dark-coloured siliceous schist, occurs in the clay schist. The whole is about 19 feet in width, and is very pyritous, containing both iron and arsenical pyrites. No gold was visible in the dish after roasting and washing some of the stone. Mr. Beaton informed me that assays by Staiger averaged between 2 dwts. and 13 dwts. of gold per ton, and that the highest assays were from the most pyritous stone. There can be little doubt that the gold is contained in the pyrites, and that there is little or no free gold in the quartz.

The tunnel has been driven 100 feet beyond this point, in a direction at right angles to the "strike" of the schists, but nothing further has been seen, and I fear there is very small hope of anything payable being discovered.

Witty's Reef.—Very little useful work has been done here since my last visit. A shaft has been sunk to a depth of 51 feet. The shaft passed through the quartz at 23 feet in depth, and below that point is entirely in clay schist.

At 23 feet in depth a drive has been put in to the north, partly in the footwall of the reef and partly in the underlying schist, but no cross-cutting has been attempted to test the reef. I have already described this reef in my report on Beenleigh, 1887, page 1.

From my examination of the area occupied by the schistose rocks, I see no reason to alter the opinion I then expressed that the prospects of finding gold, or any other metalliferous mineral, in payable quantities were very small. I have not seen one true reef in the whole district, and all prospecting has shown that, even in the veins which do contain gold, that metal is not present in payable quantities; the average being about 7 dwts. or less of gold to the ton.

Another very significant fact is that, notwithstanding the amount of prospecting that has been done, no alluvial gold has yet been discovered.

Price 1*s*.]

By Authority: James C. Beal, Government Printer, William street, Brisbane.

SECTION IN CUTTING NEAR WALTON STATION.

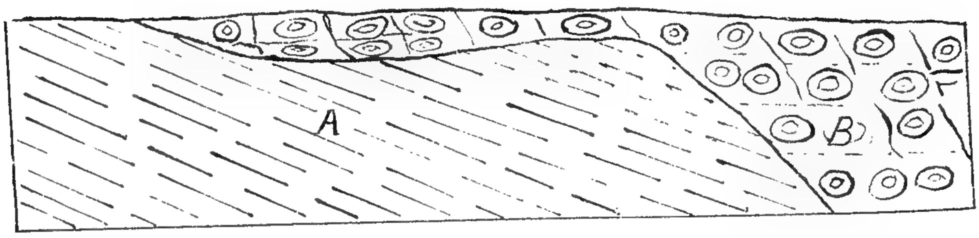


Fig. Nº 2.

A. Black and Blue Shales.
B. Sanidine Trachyte.

SECTION ACROSS NERANG AND NIXON'S CREEKS.

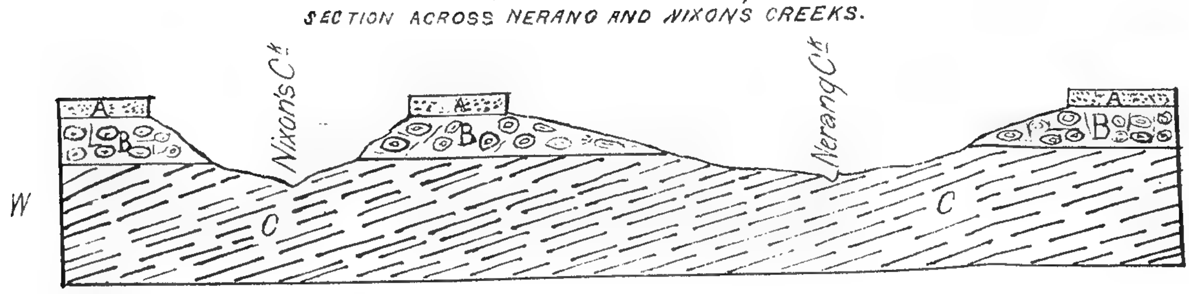


Fig. 1.

A. Desert Sandstone. B. Basalt. C. Ipswich Beds.

1889.

QUEENSLAND.

GEOLOGICAL FEATURES AND MINERAL RESOURCES OF THE MACKAY DISTRICT.

(REPORT TO ROBERT L. JACK, ESQ., GOVERNMENT GEOLOGIST, BY ANDREW GIBB MAITLAND, ASSISTANT GEOLOGIST, ON)

Presented to both Houses of Parliament by Command.

In this Report a description is given of the geological features and mineral resources of that tract of country lying to the east of the Main Coast Range, extending from Cape Palmerston to Cape Conway, and embracing an area of about 2,000 square miles, accompanied with (1) geological sketch map, four miles to an inch; (2) two horizontal sections, one mile to an inch; and (3) four plates of sections illustrating the structure of the country.

From a geographical point of view, the country may be divided into two distinct portions separated by a natural boundary, the Pioneer River. The general topographical features of the two portions are distinct and dependent upon the geological structure of the country.

The southern district, the great plain of Mackay, is covered with a fairly rich soil, and surrounded by ranges on the south and west. This extensive alluvial flat does not present many very marked physical features, but in places shows great variety in form in the little mounds and hillocks with which it is here and there covered. The plain extends almost to the foot of the range to the west, or Main Range, which culminates in a broad backed and rounded hill, Long Mountain, about 2,332 feet above the level of the sea, and presenting a steep escarpment to the seaward. It is from this range that Rocky Dam, Plane Creek, Atherton's, Sandy Creek, and numerous other smaller creeks scarce deserving of the name, take their rise, and whose waters, after carving out conspicuous features, find their way in gently undulating curves over the broad plain to the sea.

The southern portion of the plain is bounded by a low water parting, the Mount Funnel Range, terminating, near Cape Palmerston, in a conical hill, Mount Selwyn, which rises to no great height above the level of the sea. One portion of this low range is capped by a wild and weird pinnacle of conglomerate, rising almost perpendicularly to a height of 150 feet above the "back" of the water parting: this is Mount Funnel, 1,190 feet in height, a well-known land mark to mariners, and from which this ridge derives its name.

The northern district is much more rugged and broken than that to the south, and contains many larger and more important watercourses. The Main Range is separated from the sea by a rugged range, the Seaforth Hills, whose highest summit, Mount Jukes, is nearly 1,800 feet above sea level. These hills occupy a rudely triangular piece of country between the waters of Constant Creek and Jolimont Creek, the latter a main tributary of Murray or Scrubby Creek. The main or Coast Range is practically a succession of long rugged forked spurs between which the waters run in deep and narrow gullies, with occasional broad alluvial flats, the culminating point of the range being Mount Dalrymple, one of the highest mountains in Queensland, ascertained to be 4,255 feet above sea level. The most important watercourse is that of Murray or Scrubby Creek, which rises in the recesses of the Mount Dalrymple spurs, and after wending its way through extensive alluvial black-soil flats, emerges through the gorge guarded by Mounts Pelion and Ossa, and after being joined by the waters of Jolimont Creek, enters the sea between Rabbit Island and Cape Dewar. The upper reaches of this and St. Helen's Creek have not as yet been properly explored, hence the blanks existing in the topography of the existing maps.

The series of rocks exposed within the limits of the Mackay District consists of—

(A.) Recent superficial deposits;
(A.) Post tertiary conglomerates, breccia and rocksand;
(D.) Rocks probably the equivalent of the desert sandstone series;
(S.) Sedimentary rocks of carbonifero-permian age, associated with intrusive and contemporaneous outpourings of basalt, diorite, and allied rocks;
(S.) Stratiform series of volcanic rocks; and
(D.F.G.) Irregular masses of granite, diorite, and basalt of undetermined age.

(A.) RECENT SUPERFICIAL DEPOSITS.

The recent superficial deposits occupy a very large tract of country, which extends for some considerable distance along the foot of the hills by which the alluvial plain is surrounded, and has a width in some places of as much as eight miles. These deposits, as would be anticipated from the variety of rocks, vary not only in their character but also in their thickness.

The

The newest, probably, are the sand dunes which skirt the coast, and are well seen between East Point and Amhurst; these form hillocks of no very great height, and of which the landward slope is much steeper than that facing the sea. Their formation is due to the piling up of the sand, swept by high winds from the sea shore.

From an economic point of view, by far the most important deposit is that of the rich black alluvial soil, upon the productiveness of which the prosperity of the district has hitherto depended. In some places—notably on the flats which fringe the banks of Murray Creek—the black soil attains a very great thickness, whilst at the junction of Toby and McGregor's Creek eight to ten feet are visible, and on some portions of the banks of Lagoon Creek hardly as many inches occur. Wherever visible, careful search shows the presence of nodular concretions, in all shapes and sizes, of carbonate of lime, which generally have a tendency to linear arrangement, though in isolated localities they appear piled confusedly together without any attempt at order. In many localities the black soil lies directly upon the rocks beneath, but generally a thin band of clay about two inches in thickness separates the two. At other places, and more generally throughout the area in question, it is found to rest upon a gravelly sandy soil, of as much as twelve feet in thickness, made up of rounded and subangular pebbles of the rocks constituting the district, and boulders of others which have not as yet been found *in situ*, throughout the country examined.

In the vicinity of Mount Chelona, or Rocky Mountain, a great extent and thickness of very sandy soil, due to the disintegration of the granite, is met with.

At the Nebo Road Brickworks a selection showing the following strata was seen in a quarry close to the roadside:—

Alluvial mud, with calcareous nodules	3′ 0″
Sandy soil	12′ 0″
Clay	11′ 0″
	26′ 0″

The base of the clay is reported by Mr. Hardwicke, the owner, to have been full of "fossil shells," but at the time the works were visited, search failed to reveal even the slightest trace of anything that could be regarded as such.

(A)—Post-Tertiary Conglomerate, Breccia, and Rocksand.

A considerable area of the district is covered by rocks of this age: there is no direct evidence as to the age of these rocks—they may be Tertiary, but for want of better evidence they are provisionally classed as Post-Tertiary.

The greatest thickness exposed to view is in the bed of Rocky Dam Creek (Parish of Kelvin), where, after emerging from the Main Range, the creek has eaten out for itself, through the friable conglomerates and half consolidated sand, a channel 10 to 14 feet deep, which extends for some considerable distance.

In the Parishes of Sarina and Homebush, near Selections 1133 and 1268, another exposure of rock of a somewhat similar nature to that seen in Rocky Dam occurs, the pebbles of the conglomerate being made up of rocks forming the hills amongst which the waters of Atherton's Creek take their rise.

In the head waters of the Pioneer, at a height of about 180 feet above sea level, a "cement," full of rounded and subangular pebbles, lies horizontally at several places in gullies branching off into the main watercourse.

Near what is known as Halliday's Point, in the Parish of Ossa, breccia and sandstone are seen in the creeks running out to sea, and, rising in the low granite ridge, the Finlayson Hills. Some of the sandstone is nothing else than the reconsolidated constituents of the granite, and as such would be designated by French writers as "arkose," or, more properly, granitic sandstone.

In the gorge at the back of the Oakenden Plantation the sandstones are calcareous.

Near Selection 1122, Parish of Bong Bong, the conglomerate is underlain by a very friable sandstone with a few ramifying veinlets of quartz, from which colours of gold are said to have been obtained, of which, however, any of the usual methods employed in the field failed in detecting the slightest trace.

(D)—Rocks, Probably the Equivalent of the Desert Sandstone Series.

The rocks mapped as being the equivalents of the Desert Sandstone series are classed with them more on account of their analogy to rocks of that age in widely separated localities than any stratigraphical or palæontological evidence collected would warrant. Nowhere are they seen to rest upon any rocks the relative age of which has been satisfactorily made out, and all that can be at present said of them is, that they overlie unconformably all the other rocks of the district save upon those referred to Post-Tertiary age.

The strata consist of a series of trachytic lavas and subaqueous ashes, seen at intervals in the country to the north of the Pioneer, and about 450 feet of sedimentary rocks, occurring in the cliffs forming the Cape Hillsborough Tableland, and an isolated fragment of coarse conglomerate near Cape Palmerston.

The lavas and ashes will be dealt with first, as in all probability they were formed in the early days of the history of this period.

One of the most conspicuous examples of the lavas is to be found at Mount Mandarana, better known as the Black Gin's Leap, close to the Bowen road, about 12 miles north-west of Mackay, where it forms a broad tablelike mass, rising to a height of 650 feet, by corrected aneroid, above the level of the road. The rock of which the Leap is made up is lithologically a trachyte, and may be generally described, when examined with a lens or the unaided eye, as consisting of a light-coloured porous matrix in which crystals of sanidine and minute crystals of what appear to be hornblende are embedded. It is seen (Section 1) to rest upon black shales, at a point in a gully flowing from the north-west corner of the mountain 300 feet above the road; at the junction of the two the shales for a few inches are slightly hardened. The lower portion of the sheet is made up of rudely hexagonal curved columns, the outward curvature being northwards. The structure of certain parts of this rock would seem to imply that in reality it is a succession of lava flows of variable thickness; the estimated thickness of the sheet is not less than 350 feet.

On

On the low hills on either side of the road, at no very great distance from the Leap Post-office, a bed of fine-grained yellowish-white ashy sandstone with scarcely a trace of bedding is seen to overlie the sandstones and shales (Section I). From the similarity of the components of these sandstones to those of the Mandarana lavas, and their apparent unconformability to the underlying rocks, they are regarded as being subaqueous trachytic tuffs of the same age.

Another fragment of rock of this class is seen capping the Finlayson Hills, 22 miles north-west of Mackay and about $1\frac{1}{2}$ miles from the sea-coast, where it forms a sugarloaf-shaped peak, resting on granite and rising to a height of about 100 feet above the summit of the hills (Section II). The rock has a matrix of a purple-grey hue, with well-marked banded or ribboned structure. in which the lines of flow can often be seen to bend round the larger sanidine crystals embedded in the base. As a whole, the rock is much more compact than the Mandarana trachyte, and like it forms rudely hexagonal columns.

On the eastern bank of Victor Creek, in Selection 590 (parish of Ossa), a well-marked escarpment of trachyte, forming the McKenzie Crags, occurs. Here the lava rests upon the volcanic series (Section III).

Several other isolated fragments occur near high-water mark at Rocky Bluff, about $4\frac{1}{2}$ miles south of Cape Hillsborough.

Near the head of Niddoes Creek, one of the watercourses draining the western side of that range of hills lying between the main range and the coast, a trachyte lava of a somewhat different character is seen dipping south-east at an angle of 12 degrees, and resting upon the sedimentary rocks of which this range is made up. Lithologically the rock may be called a quartz-trachyte, and throughout it presents a great uniformity in its physical characters; it is made up of a light-grey porous matrix, in which quartz sanidine and small specks of what appear to be hornblende are embedded.

In the Parish of St. Helens, on the south bank of Alligator Creek, a lofty ridge of mountains, the Pinnacles, which form a corry, encircling one of the branches of this creek, a great thickness of lava occurs. The rocks are trachytes of a brownish-grey colour, and with which fine-grained trachyte tuffs are associated. The lava sheets have their steeper faces southwards and appear to dip in a general northerly direction. One of the sources from which some of these lavas and ashes have been ejected appears to be Mount Barron, a steep triple-peaked mountain, the highest summit of which is about 2,000 feet above sea level, and which is almost surrounded by the head waters of St. Helens Creek (Section IV.). The rock of which this mass is made up is greyish-white in colour, and somewhat porous, with a mean specific gravity, as determined by a Walker's Specific Gravity Balance, of 2·56. In the matrix small crystals of sanidine and minute specks of a black mineral—probably hornblende—can be recognised; throughout the whole mass: the rock retains very much the same character. The mountain rises perpendicularly from the alluvial flat on the north bank of St. Helens Creek, and in Barron Creek the mass is seen to be intrusive through an "orthoclase prophyry" upon which the sedimentary strata are seen to rest. No perceptible amount of alteration was detected in any of the sections in which its intrusive character was observed.

Another denuded wreck of an old volcano is to be found in Mount Jukes, some 1,800 feet above sea level, and situated on the bank of Neilson's Creek, and about 20 miles distant from Mackay in a north-westerly direction. The mean specific gravity of the rock from specimens in different parts of the mountain was found to be 2·55. Different parts of the mass present different characters, but generally two varieties can be recognised—

(*a*) A coarse-grained rock in which a matrix can scarcely be said to exist; and

(*b*) A second in which crystals of sanidine and plagioclase are embedded in a microcrystalline base, which with the aid of a lens is seen to be made up of small crystals and crystalline grains of sanidine and hornblende (?) The former variety, owing to its coarse grain, would be called a nevadite, whilst the latter would be best described by the term sanidine-trachyte: both, however, are merely varieties of one and the same rock. The rock is intrusive through the volcanic series, and sends out here and there dykes of no great thickness, and of a somewhat similar character to the rock forming the main mass; hardly any apparent alteration has taken place in the rocks through which the mass has burst.

On the north side of the Bowen road, near its crossing of Murray Creek, a low hill opposite to Mount Ossa, known as Hammel's Hill, is found to consist at its base of a coarse volcanic ash or agglomerate, made up of trachytic materials, and above which a rock not unlike that forming the "Sugarloaf" at Seaforth lies. This seen in a bare scaur visible from the road shows fluxion structure to the unaided eye, and in places fragments of the ash appear to have been caught up in the lava when in a molten condition and dragged along with the viscid mass. The whole rock subsequently has been pierced by a fine-grained granite, and the agglomerate much altered, rendering it often, except on its weathered face, a matter of some difficulty to distinguish it from some forms of the lava beds.

The Scrubby Hill, Mount Ossa, behind the house in Selection 1585, is, judging from the screes on its face, made up of a rock almost identical in physical characters with that forming McKenzie Crags.

As a whole these rocks bear a remarkable resemblance to those of Mount Britton: some of the rocks there are very fine volcanic ashes, whilst others are true lavas The "Stalk," a conspicuous pinnacle of rock on the divide between the waters of the Fitzroy and the Burdekin, "possibly one of the vents from which the volcanic material of the bluffs in the neighbourhood of Mount Britton was ejected," is almost identical with the trachytes of Mounts Barron and Jukes.

The Mount Britton rocks have been conjectured by Mr. R. L. Jack to belong to the desert sandstone series, "whose base is often made up of similar volcanic dust."

The Mount Funnel conglomerate, merely an outlier of this series, rests upon the altered grits and conglomerates of carbonifero-permian age, and is distant not less than 45 miles from any rock its equivalent in age, and forms an impressive evidence of the power of denudation.

The sedimentary rocks at Seaforth overlie a mass of prophyrite regarded as being newer than those of the "volcanic series," and which is well seen in a little bay at Cape Aberdeen, a mile to the south of Cape Hillsborough. Here, the porphyrite is well seen in the cliffs at low water; it weathers into rude spheroidal masses, and where a freshly broken surface is examined it is often found to be amygdaloidal, the greater part of the cavities being filled with carbonate of lime, though in some leucite can be detected.

Overlying

Overlying the porphyrite a thickness of grits and fine conglomerate, and in some places nearly pure white calcareous sandstones, occur. At one place directly overlying the porphyrite a bed of "mudstone" is seen; some little distance north this covers a great bank of conglomerate, which in turn is succeeded by the main mass of grits, &c.

The Cape Tableland is made up of about 450 feet of sedimentary materials, dipping at an angle of about 10 to the west-south-west. The base consists of a thick mass of cavernous and ferruginous sandstones, succeeded by whitish conglomerates and breccias with thin beds of banded siliceous matter. Whether these beds were formed by slow precipitation from springs charged with siliceous matter, or are beds of fine volcanic dust subsequently cemented, there is no evidence at present forthcoming to show. Hot springs are frequently met with in those districts where volcanic action is or has been rife; hence the siliceous bands occurring among the beds of the Cape may only be the indirect result of that activity which is conjectured to have taken place in the earlier stages of this period.

(s.) Sedimentary Rocks of Carbonifero-Permian Age associated with Intrusive and Contemporaneous Outpourings of Basalt, Diorite, &c.

By far the greater portion of the stratified rocks in the district have suffered more or less alteration by the protrusion of rocks of various classes and of different ages, but nowhere has the metamorphism proceeded to such a degree as to entirely mark their clastic character.

The geological age is carbonifero-permian. In no place is one continuous section seen, but by piecing together the materials gathered from what exposures are visible in the creeks, a fairly accurate idea of the character and structure of the district can be obtained.

The series will be best described by giving an account of the sections visible in the areas drained by the respective watercourses, commencing with Rocky Dam Creek and proceeding northwards:—

Rocky Dam Creek.—The rocks exposed throughout the area drained by these waters have undergone a great amount of alteration, some of the grits assuming the appearance of some varieties of quartz-felsites, whilst some sandstones have been altered into quartzites.

Northwards from Mount Funnel itself, in several gullies, horizontal beds of conglomerate, and sandstone of various degrees of colour and texture, are exposed; at one place near Mount Selwyn one bed is a green felspathic conglomerate in which clear and pellucid blebs of quartz appear to have been developed subsequent to its formation.

Where the St. Lawrence road crosses Rocky Dam Creek a bed of coarse grit dipping at a low angle to the east is seen; further up the creek on its southern bank, in Selection 1442, a low hill of dolerite weathering to a rusty-brown colour occurs: this is probably intrusive through the sedimentary measures. In the bed of Rocky Dam Creek an altered sandstone is seen, higher up the creek, but no dip is obtainable, whilst on a mountain bearing 52° 30′ from Mount Funnel the seaward face is seen to consist of a great thickness of an altered conglomerate with an intrusive felsite dyke.

Cone Mountain, on the south side of the creek of that name, is on a spur on its western face, made up of a massive quartzite lying apparently horizontal or nearly so. From this point in a traverse northwards, across Rocky Dam and Arrowroot Creeks as far as the Eildon Hills, altered sandstones and shales are to be seen at intervals.

No measurements could be made which would give a determination of the thickness with any approach of accuracy, owing to the great mass of intrusive granites, &c., which occupy a considerable portion of this drainage area.

Cherry Tree Creek.—On one of the branches of Cherry Tree Creek flowing through Selection 1531, a baked black shale is seen dipping at 35° E.S.E., and what appears to be a volcanic breccia is visible close to the great mass of rock mapped as diorite, and which occupies a considerable area of country close to the St. Lawrence road.

About three-quarters of a mile N.E. from the house in Selection 1569, in the bed of Cherry Tree Creek, a conglomerate is met with underlain by reddish-brown shale, both altered, through which a felsite, now much decayed, has been protruded, and subsequently flowed over the surface of the conglomerate as in Section 12.

Following up the watercourse from this point a great thickness of conglomerate is passed over. Its base is very coarse in grain, but higher up it becomes much finer with a large quantity of felspar, a little quartz, and iron pyrites developed in the mass; a dyke of felsite occurs in the conglomerate, whilst near the head of the creek an intrusive mass of granite forms the summit of the range at this point.

Plum Tree Creek.—The prevailing rocks between Cherry Tree and Plum Tree or Boundary Creek, seen at intervals along the low hills which skirt the road, consist of a great thickness of altered grits, conglomerates, and sandstones with an intrusive felsite dyke. Near the dyke, secondary crystals and crystalline grains of quartz are developed. The beds are horizontal.

Plane Creek.—On the north side of Plane Creek reddish felspathic sandstones are seen to dip at a high angle S.W., and to be penetrated by a dyke of diorite which runs in a general north and south direction.

The dividing ridge between Tara Creek and Atherton's Creek is seen to be made up of fine-grained altered sandstones with sandy shales dipping at 5 degrees to S.S.E. in which no recognisable fossils were met with.

Atherton's Creek.—In Alligator Creek, one of the heads of Atherton's Creek, the rocks seen in Section 13 occur.

Here the sedimentary rocks, with a contemporaneous sheet of diorite, have been pierced by protrusions of felsitic rocks.

From the base of the felstone sheet to the top of the grit forming the summit of the range is 260 feet.

Bell's Creek, geographically a branch of Atherton's, shows the rocks seen in Section 5.

Altered slates are seen in the bed of the creek below Selection 1293; for some distance no section is visible until a thickness of grits, and shales dipping at an angle from 15° to 20° W.S.W., comes on. These overlie the shales seen lower down the creek. Above these an intrusive (?) sheet of a porphyritic felsite

felsite is seen to be overlain by a greyish-yellow shale and sandstone, the whole being pierced by an intrusive boss of diorite which alters the slates into lydianstone and the grits into quartzite. A band of ferruginous altered sandy shale is crowded with plant remains, but although some considerable time was spent in fossil collecting, nothing was discovered in a state sufficiently preserved to venture a name being given.

These are succeeded by a series of dark shales and grits dipping at 10° to S.S.W., in which a sheet of felsite is seen to be intruded along the bedding planes, and doubtless connected with a vertical dyke of a similar rock seen some little distance higher up the creek.

At a height of about 1,000 feet above the place where shale was first seen, a conspicuous bed of rock of what appears from below to be of a white colour is seen to form an escarpment traceable for some considerable distance northwards. The white colour of the surface is merely due to a species of fungus with which the surface has been overgrown. The rock is a felsite 12 to 14 feet in thickness intruded between the bedding planes. Above it lies with a very low dip to the west shales and sandstones, the summit of the range at this point being 1,420 feet above the base.

Sandy Creek.—This watercourse with its numerous tributaries of more or less importance drains a very considerable extent of country; it takes its rise in that range of granite hills in which Ben Mohr, Mount McBryde, and Mount Bridgeman form the most prominent summits, and, after uniting with the waters of Cut Creek, Bagley's Creek, and Lagoon Creek, empties itself into the same inlet as that which receives the waters of Atherton's Creek.

In one of the gullies behind the Oakenden Plantation the series of rocks in Section VI. are well seen.

A recent calcareous conglomerate is first passed over lying horizontally upon the other strata at a height of 100 feet above the sea level; below this a band of indurated shale is seen overlain by a semi-vitreous sandstone or quartzite through which a dyke of granite somewhat similar in character to some of the granite forming the hills of which Mount Bridgeman is the highest point has been protruded. The induration of the sandstone and shale is due to the intrusion of the granite dyke, but the contact metamorphism does not extend for any great distance on either side of the granite.

For some distance above this no section is seen, but judging by the "lie of the country" the rocks beneath are shales: these are actually seen, some distance higher up, to be dipping S.S.E. at an angle of 5°, and to be overlain by a thick bed of semivitreous grits with a felsitic dyke; from this point to the summit of the range, 1,300 feet above sea level, the rocks seen are nothing but slightly indurated black shales.

In a creek parallel to this and running into the same watercourse a section somewhat similar is seen (Section VII.).

The beds first seen are shales overlain by a bed of altered grit dipping S.W. at an angle of 15°; some bands contain plates of mica; several apparently intrusive sheets of basalt occur among the strata, and a granite dyke. Some distance up the creek a fault is seen throwing quartzite against quartzite, and on either side of the fault for some little distance the beds are much shattered and broken. The fault has a slight hade to the north-west and a north-east and south-west course.

Above the faulted quartzite a bed of hard blue shale dipping S.S.E. at 18 degrees is seen. From this to the summit alterations of indurated grits and shales are met with, the summit being composed of a hard sandstone weathering into long vertical slabs.

In a gully S.W. of Section 1611, the hills are composed of coarse massive grits lying horizontally, their geological position being above those seen in the last section.

Round Homebush Hill, or Corn Tweed Hill, some distance west-north-west of the mill in the plantation of that name, whitish shales are seen dipping at an angle of 55° to 60° to the east, and indurated shale is seen also in the road running through selection 667. Altered shales and sandstones with a quartz felsite dyke are seen in the hills in the neighbourhood of the mountain, but owing to the long grass, sections, save at widely separated intervals, were rare. Remains of reed-like plants and fragments of silicified wood are common, but too indistinct for determination.

Where the creek crosses the junction between 775 and 1603, sandy shales are seen dipping at 20-25° E.N.E. with a sheet of "felspar porphyry;" at Selection 1380 sandstones and shales crop out in the bed of the gully; the sandstone contains fragments of silicified wood, and the shale plant remains.

Near Dalrymple's Look Out, altered shales are seen, and on the eastern face of Mount Vince altered sandstones are exposed here and there.

In a waterhole in Selection 774 east of Mount Kinchant, close to the fence, shales are seen dipping at 25° N.E.; further north, where the stream crosses the road, buff-coloured shales overlain by a bed of grit is seen dipping at 15° N.N.W: a fault with a N.W. and S.E. strike propably separates the two.

In Selection 1380 beds of sandstone crop out in the gullies; from the house in this selection, in an ascent of Mount Kinchant, a series of volcanic rocks is passed over until a height of 350 feet is reached, when a series of altered sandstones and shales dipping at an angle of 5° to 8° to S. 85° E. is met with; these judging by boulders in the scrub—for no section is seen—continue to a height of 950 feet, when a mass of fine-grained basalt is seen on a bare knob due west from Eton on the flanks of the higher peak to make up the remainder of the mountain.

From base to summit the whole of the rocks have undergone more or less alteration; in one case a bed of grit was seen to be so much altered that it assumed the appearance of a felsite—its weathered surface and its mode of occurrence and general appearance showed that the rock was a fragmental one.

In the cutting at the terminus of the Eton Railway the section (in Sec. 8) is seen—

(*a*) (*a*) Baked greyish and buff coloured shales, dipping from 20° to 30° N.N.W., much shattered.

(*b*) As in sandstone.

I. Intrusive dyke of decayed felsite which does not reach the surface.

(*a*) Altered grit (?) faulted against shale seen in the end of the cutting.

One of the branches of Cut Creek shows alternations of sandstones and shales with an intrusive diorite: following up the gully until due east of Mount McBryde a horizontal bed of altered conglomerate is seen.

The

The Pioneer River.—The country drained by the Pioneer River and its tributaries is rudely triangular in shape, and of about 600 square miles in extent, but by far the greater portion is occupied by crystalline rocks and alluvial soil; it is only here and there that any sedimentary rocks are seen.

In the bed of the Pioneer near Dumbleton (Section 9) is an exposure of intensely metamorphosed sandstones, grits, and shales, with intrusive dykes of basalt and diorite.

Plan 1 (long sections) shows the direction taken by dyke (*a*), the vertical upright lines being joints with which the rocks here are seamed.

Higher up the river below the bridge at Pleystowe Mill a series of black shales showing little or no alteration save a slight increase in hardness within a couple of inches of a dyke of diorite porphyrite with which the rocks are associated.

In the quarry reserve on the north bank of the Pioneer there is another exposure of an altered grit, but slightly different in character to that seen in the bed of the Pioneer at Dumbleton.

In the hills to the south of Ashburton Mill, sandstones and shales are seen dipping west at 25° to 30°, and near the north-east corner of a paddock marked 639 on a tree a bed of volcanic ash occurs among the sedimentary rocks.

In the hills between the Ashburton and the Bowen Road black shales are seen dipping E.N.E. at 15°, and above this boulders of conglomerate and diorite occur. The shales are slightly indurated. Black Water Holes Creek rises in a deep scrubby gorge whose sides show sections of coarse altered sandstones and grits, below which black sandy shales are seen to dip to the east at an angle of 10°.

One of the main tributaries of Black Water Holes Creek shows a quartzite underlain by a very hard lydianised shale lying horizontally; further up the creek in Selections 1602 and 1114 the rocks are pierced by an intrusive granite somewhat coarse in grain.

Lower down the creek greyish-coloured sandstones and black shales are seen to dip at an angle of 15° to the west.

Several other tributaries of the Pioneer in various parts of their course show sandstones and grits all more or less metamorphosed, so much so in some places that in the absence of "bedding planes," ripple marks, &c., they might easily be mistaken for some forms of granite.

On the spurs of the Main Range, between Cattle Creek and one of its tributaries, Dalrymple Creek, the gradual passage from a comparatively unaltered grit into a granite, can be satisfactorily traced.

Starting with a grit showing distinct traces of bedding, a quartzite is next seen, passing in turn into what appears to be a porphyritic felsite and ending in a true granite.

Several similar instances can be seen in this area. One other noteworthy case occurs near Snake Hill in the divide between the waters of Black's Creek and Stockyard Creek: here a micaceous sandstone is seen to merge almost insensibly into a medium-grained granite which is regarded as being intrusive and not metamorphic. It has been impossible within the limits of the small scale map (two miles per inch) from which the accompanying map has been reduced by Mr. Gustav Von Wehrs, to distinguish between the granites and metamorphosed grits; hence all are mapped as granite.

The series of rocks seen in Mount Toby, about three and a-quarter miles N-west of the junction of McGregor's Creek with the Pioneer, as depicted in Section 10, consists of—

(*a*) Coarse massive grit or fine conglomerate, dipping at an angle of from 5° to 10° to the N.W.
(β) Sandstones with thin bands of flaggy sandstone, and a thin band of sandy shale.
(γ) Clay shales.
(δ) Grit with fragments of shale.
(ϵ) Sandy shale with concretionary nodules of clay ironstone.
(ζ) Thick mass of false-bedded sandstone with thin bands of shale dipping at 5° to 7° north.

The whole having a total thickness of 760 feet.

Mount Toby presents a steep escarpment S.E. As the false-bedded sandstone is followed north it is found to consist here and there of a quartzose conglomerate whose pebbles are of medium size, more suggestive of banks of shingle than beds of rock.

Some of the weathered surfaces of grit here show slickensided surfaces of quartz stained with a film of oxide of iron.

A conspicuous knob close to the junction of McGregor's Creek and the Pioneer River consists at its base of a coarse conglomerate, passing upwards into a fine-grained grit with a low dip to W.N.W.

The succession seen in Mount McGregor is similar to that at Mount Toby, and the beds dip W.S.W. at an angle of 15°.

At several places along the slopes of the hills on the southern banks of the Pioneer, near the Blue Mountains, sections occur showing horizontal sandstones and shales interstratified with lavas and ashes.

At one place opposite Selection 1221, Parish of Bong Bong, a bed of fine-grained diorite is seen to overlie a horizontal bed of grit above the diorite; further up the hill a bed of volcanic ash made up of subangular fragments of rock is seen.

Constant Creek.—In the bed of Constant Creek, a little way below Selection 756, a bed of black shale dipping S.S.W. at 10 degrees is found to contain three bands of fire-clay varying from one to four inches in thickness. These have often embedded amongst them flat circular concretionary nodules of siliceous matter. In Selection 1358 the shales are vertical and are faulted against a fine-grained sandstone. In the township reserve east of Mount Jukes sandstones and shales with an intrusive "orthoclase porphyry" dip at 20° to the N.W. The creek rises in the Mount Toby range, and flows over alternations of grit and shale which here roll about a good deal, and are well seen in the Bowen Road between the Leap and Jolimont Station.

Murray Creek.—Murray Creek takes its rise in one of the spurs emanating from Mount Dalrymple, and like the Pioneer drains an area mainly composed of crystalline rocks. The only tributary it receives whose waters flow over rocks of sedimentary origin is Jolimont Creek.

The rocks exposed in one of the branches of Jolimont Creek behind the Beaumont Store, and flowing from Mount Blackwood, are shown in Selection XI.—

(1) Black shale seen in a well behind the house, with one or two very carbonaceous bands.

(2) Semivitreous

(2) Semivitreous white sandstone dipping at 10° N.N.E. In the bed of the creek this bed is seen to turn over and dip at 50° to S.S.W., forming a broad synclinal trough whose strike is E.N.E. and W.S.W.

(3) Massive fine-grained sandstone slightly indurated.

(4) Sheet of felsite intrusive (?)

(5) Intrusive diorites, &c.

Below the Beaumont store, in the bed of the creek, a sheet of diorite is seen overlying a bed of argillaceous shale.

At the foot of Mount Roy, on the western bank of Jolimont Creek beneath a capping of clayey soil, an exposure of decayed diorite is seen about 100 yards from the main road, which weathers in places into nodular and exfoliating masses.

Above this lies a white semivitreous grit exposed on a low hillock to the left of the creek, succeeded by a contemporaneous sheet of dolerite 10 feet in thickness forming a conspicuous escarpment to the west, which in turn is overlain by a thick mass of sedimentary materials made up of white semivitreous sandstone, quartzose conglomerate, and yellowish grit, the whole dipping at 5° to 8° N.W.

The summit of Mount Roy is covered with large blocks, many tons in weight, of yellowish-white fine-grained sandstone somewhat laminated in structure.

In the bed of McArtney's Creek, where it is crossed by the Bowen Road, a contemporaneous sheet of diorite dipping at a low angle to the east is overlain by a bed of very sandy shale separated by bands of yellowish-white clay about one inch in thickness.

An outcrop of a medium-grained semivitreous sandstone is seen near Palm Tree Creek on the Bowen Road, where the rock has been used for the purpose of repairing the road: some portions of the rock have the appearance as though a second deposition of quartz had taken place subsequent to its formation. The sandstone is seen at one place to be underlain by an ash or fine agglomerate.

Near Selection 1251, Parish of Ossa, a small hillock is composed of reddish ferruginous shale with an easterly dip of from 5° to 10°. The shale is somewhat sandy and weathers into rudely spheroidal masses: some bands stand out more prominently than the rest.

Further north along the road a low range is seen, on either side of which can be traced the escarpment of the stratiform series; the beds dip at an angle of 25° E. Here in the semivitreous sandstone a bed of sandy shale is intercalated: at one place the shale dips at 15-20° S.E.

In a quarry alongside the road a contemporaneous sheet of diorite 2 feet thick, weathering into spheroidal masses, is overlain by beds of argillaceous shale which dip S.E. at 40° beneath the dioritic lava: argillaceous sandstone and shales separated by a bank of clay occur. These beds underlie the whitish semivitreous sandstones seen further south.

An outlier of sandstone and fine quartzose conglomerate occurs on the eastern bank of the Silent Grove, where it forms a conspicuous escarpment, the Grey Cliff, 800 feet above the alluvial flat in Selection 1231, parish of Pelion.

St. Helen's Creek.—The waters of St. Helen's Creek drain an area of very considerable extent; their upper reaches, as seen from the summit of Mount Barron and Mount Dalrymple, consist of comparatively untimbered black-soil flats hemmed in by dense belts of scrub, and have not as yet been properly explored. The greater part of the country, judging by boulders seen in the bed of the creek, appears to be mainly made up of crystalline rocks of different classes.

On the south bank of the creek, and about two miles distant from the road, the sedimentary rocks are seen lying directly on an uneven surface of "felspar porphyry." The escarpment of the stratiform series can be traced for some considerable distance, and is well seen when the creek eats its way through a narrow gorge, well nigh impassable in its present condition, whose flanks are made up of beds of semivitreous sandstone and coarse conglomerate dipping at 5° to the west.

A low gap in a range between St. Helens head station and Mount Barron is made up of grits and fine conglomerate which dip at 55° to the N. 50° E.

On the broad alluvial flat between the Main Creek and one of its tributaries, One-Mile Creek, a small mass of white sandstone rises like an island at no very great elevation above the surrounding country.

In Black Rock Creek a similar succession is seen, but near Selection 1450 a seam of inferior coal is exposed in the bed of the creek; the coal is vertical and is 2 feet 3 inches in thickness, and is intruded into by a sheet of greyish diorite. Some distance above this a thick bed of altered sandstone, dipping at a high angle to the east, is seen; this is a continuation of the strata seen in St. Helens Creek, and is apparently faulted, throwing the coal, &c., against the grits.

The coal is overlain by buff-coloured shales in which no fossils were found.

Sandstones, grits, and shales, with sheets of diorite and dolerite are seen at intervals in the low hills between Black Rock and Alligator Creek.

In reviewing the whole of the sedimentary rocks abovementioned, they appear *prima facie* to belong to one series, no unconformity having been detected in any part of the district examined. A small patch of slates at Alligator Creek, described below, are conjectured to be of older date than the Bowen River Beds. They are supposed from their lithological resemblance to be the equivalents of the Bowen River Beds, but in this district the tripartite division made out in the area where they were first studied cannot be made out, unless, indeed, the "volcanic series" represent the "Trappean series," and the semivitreous white sandstone forming Mount Roy and Mount Moleyns be the base of the middle series, in which case the lower series is concealed beneath superficial accumulations. Or if, as is conjectured by Mr. R. L. Jack ("Geological Features of Mackay," 1887) the Mount Roy beds are the base of the lower series of the Bowen River Beds, the "Trappean series" is awanting. That volcanic action went on during the period when the sedimentary strata were formed in the Mackay district is shown by the presence of undoubedly contemporaneous lava beds, and it may be that the horizon of volcanic action was changed to different portions of the series in different localities, this being by no means an unusual freak of nature with regard to volcanic activity.

(s.)—Stratiform Series of Volcanic Rocks.

The stratiform series of volcanic rocks, upon the uneven surface of which some of the sedimentary series were laid down, are best developed on the northern side of the Pioneer River, where they cover a a considerable tract of country.

In

In no place was their base seen, and consequently no estimation of their thickness could be made.

The rocks forming the series are diorites and basalts with breccias and agglomerates, hand specimens of the whole of which appear unusually fresh.

A good exposure of the rocks is seen in Toby Creek: here a diorite porphryite is seen to be overlain by an agglomerate made up of rounded and subangular blocks of diorite, the whole being capped by a sheet of dioritic lava which dips at 10° to the N.W. Some distance east a dyke of intrusive basalt which does not penetrate the sedimentary rocks is seen in the bed of the creek.

Nowhere do these rocks form any conspicuous feature, occupying as they do the rounded knobs on the lower ground.

Behind the house in Selection 930, Parish of Hamilton, a little hillock made up of a fumultous assemblage of blocks of diorite is probably one of the sources from which the volcanic matter emanated.

In the field there is a great similarity among the rocks of the volcanic series: microscopic examination would doubtless reveal the fact that they are not all of the same mineralogical composition and structure.

(D.F.G.)—Irregular Masses of Granite, Diorite, and Basalt of Undetermined Age.

The granite rocks extend over a considerable area. In composition they vary from fine granites to syenites, between which varieties no hard-and-fast line can be drawn.

There appears to be two different ages of granite, with the possibility of a third—but this, however, is a point requiring much more detailed work in the field than the time admitted of. It has been found, save in two instances, almost impossible to distinguish by colour the granites of the different ages.

Where the granite is exposed, the topographical features present the usual characteristics common to nearly all granite countries; few sharp peaks are visible, denudation having worn off all the angularities, and leaving in places huge cuboidal blocks standing on the summits and faces of the ridges.

Mount Chelona, or Rocky Mountain, in the Parish of Hector, some 750 feet above sea-level, consists of a very coarse granite containing quartz, felspar, and biolite. For some considerable distance around the mountain the soil is very sandy, and in places it attains a great depth.

In the Finlayson Hills, Parish of Ossa, a yellowish-coloured coarse-grained granite occurs. It is upon this that the sedimentary and associated volcanic rocks appear to rest.

The granite forming Long Mountain, and the range to the south, is intrusive, as is shown by Sections 5, 6, 7, and 13. In Cherry Tree Creek the conglomerates and grits are much altered by the intrusion of the granite, and in some places the mass is seen to send out dykes of granite and felsite into the surrounding rocks.

In the Eildon Hills, near Kelvin Grove Station, the rock is very fine in grain, whilst that at Long Mountain is exceedingly coarse in this rock; hornblende often replaces and accompanies the mica.

At Corn Tweed Hill, near Homebush, a granite is seen to be intrusive through the volcanic rocks forming the greater portion of the hill. It is in colour yellowish-white, and contains dark hexagonal plates of mica, flesh-coloured felspar and crystals, and crystalline grains of clear and pellucid quartz.

The granitoid boss of which Ben Mohr and Mount McBryde is made up is very variable in character in different parts of its mass.

In the bed of Black Water Holes Creek the granite is fine in grain, containing quartz, pink orthoclastic felspar and hornblende. In some portions the felspar is white in colour, and where this is the case the hornblende appears to be more plentiful. Throughout the mass veinlets of quartz and felspar occur, the latter in some places being green in colour, probably in the earlier stages of "Saussurisation." Near the summit of Mount Charleton, 1,300 feet above Stockyard Creek, several exposures of fairly fine-grained granite occur, and in some places there appears to be a tendency to a linear arrangement of the constituent minerals: the granite is found to gradually shade off into a rock containing no mica.

Several dykes of quartz felsite emanate from this mass of granite. One of considerable thickness is to be seen on the south bank of Black Waterholes Creek. It consists of grains and crystals of quartz, and an orthoclastic felspar set in a chocolate-coloured matrix.

The heads of the Pioneer above the township of Rothesay drain a country practically all granite. At the Twins Castor and Pollux, on the eastern bank of Owens Creek, the granite, with felstone containing a few plates of mica, is seen to be intrusive through the diorites. Further up the main watercourse, near the western boundary of Selection 1513, a medium-grained hornblendic granite is seen, sending out veins into a fine-grained micaceous rock not unlike a mica schist. The granite occurs in lenticular patches in the schist of no great extent. A dyke of felsite running N. and S. crosses these rocks at this point.

This granite would appear to be older than that forming the Twins, and the equivalent of the Mount Chelona granite.

The granite of Hammel's Hill and Carey's Creek are at present regarded as younger than the desert sandstone from their intrusive character through rocks of that age.

Could lithological resemblance be safety employed in the determination of geological age, one would be inclined to regard the granites of the Eildon Hills as post desert sandstone also; that they are intrusive through the sedimentary strata of carbonifero-permian age, Sections 5, 6, 7, 8 clearly show.

Should subsequent investigation prove this to be their age, interesting cases occur at Hammel's Hill and the Eildon Hills of comparatively recent granites presenting, so far as an examination without the aid of the "refinements" of modern petrography goes, no visible difference to those much lower in the geological scale.

In Boulder Creek, granite with felstone dykes make up the greater portion of the country, and at one place a curious breccia made up of subangular fragments of quartz in a siliceous matrix occurs, but nothing is seen to indicate the relation it bears to the surrounding rocks.

From Carey's Creek to Mount McArtney the main range is made up of granite, which on the slopes of the latter mountain is seen to send out veins into the volcanic rocks of which the lower grounds appear to be made up.

A great mass of intrusive basalt is well seen in a creek flowing into the Pioneer from the Blue Mountains, east of Selection 1221, parish of Bong Bong: here the rock is very evenly grained with three dykes of porphyrite similar to those seen to be intruded through the sedimentary series at the back of

Oakenden

Oakenden Plantation. A breccia of volcanic materials occurs at a height of 500 feet above the bed of the river. This breccia appears to be interstratified with the basalt, and is made up of subangular fragments of felspar, and what appears to be basalt embedded in a greyish lavalike matrix.

At present there is no evidence to show whether this breccia is a subterranean product or was formed on the surface.

The bed is of no great thickness, nor can it be traced for any considerable distance.

Masses of diorite—using the term in a generic sense—are met with frequently throughout the district. They vary greatly in texture and character. The rock forming Grahn's Hill, in Selection 661, parish of Abingdon, is a quartz diorite, whilst that forming some of the intrusive masses in the Silent Grove is a porphyritic diorite, and that near Hill End from its coarseness in grain would be called a granular diorite.

In addition to the above masses of diorite, &c., there appears to be a much younger series of volcanic rocks developed in the district. To this series the rocks of Mount Martin in Jolimont Creek, and Mount Lawler in the Silent Grove, belong.

These are arranged in thick well nigh horizontal sheets rising generally to a considerable elevation above the level of the surrounding country.

The Mount Martin lavas rest upon a sheet of trachyte not unlike some of the Mount Jukes and Mount Barron rocks—using this to mean the lavas which at one time or another have flowed from either of the two sources.

The Mount Lawler beds rest upon the volcanic series. Its base consists of volcanic ash overlain by an amygdaloidal porphyrite in which crystals of flesh-coloured felspar and hornblende (?) are set in a yellowish-brown matrix with the amygdaloidal cavities filled with carbonate of lime.

A conical mountain in the Silent Grove, locally known as McLean's Look Out, rises to a height of 820 feet above the alluvial plain, and is formed of a dioritic rock of a somewhat similar nature to that forming the rest of the hills, but at its base, on its north-east face, a very coarse agglomerate with boulders of very large size occur. From the shape of the hill, and the position of the agglomerate, it is regarded as being the remains of one of the volcanoes from which the mass of volcanic matter was derived.

ECONOMIC GEOLOGY.

Gems, &c.

Of precious stones none to which this term could be properly applied have as yet been discovered in the district of which any authentic record has been kept.

Fragments of opal are of frequent occurrence in the débris at the foot of the Cape Hillsborough cliffs. In addition to these fragments beautifully banded agates are not uncommon.

From the sandy gravel in the sheltered nooks of some of the heads of Constant Creek numerous zircons have been discovered; these occur both as small crystals and grains of a deep-yellow or reddish-brown colour, all more or less rounded by attrition.

Up to the present no very valuable crystals are reported to have been found, though it is not improbable, considering that every "dish of dirt" washed was found to contain great numbers of zircons, that diligent search may bring such to light. Their exposure, however, to the wearing action of currents is a factor which tends to prevent the crystals being preserved in that perpect condition necessary to fit them for use as gems for personal adornment.

Within recent years attempts have been made to make use of the brilliant light of incandescent zirconia, and it has been thought that an "inexhaustible supply might be obtained from those rocks, soils, and sands" in which zircons are of no uncommon occurrence. Hitherto the difficulty appears to have been the almost entire absence of a method of concentration which would prove remunerative owing to the almost microscopic dimensions of the crystals. In the sands at the head of Constant Creek crystals half an inch in length are by no means uncommon.

In many of the watercourses taking their rise from Mount Jukes and falling into Neilson's Creek, deposits of Titaniferous ironsand occur; the sand, in addition, contains grains of magnetite and quartz.

BUILDING STONES, &c.

Good building stone occurs in large quantities in the district, and within comparatively easy reach of the town; that mass of sandstone capping the hills on the west side of the Bowen Road, between the Leap and St. Helens, being probably about the best of any of the sandstone.

Several of the granites, and many of the breccias associated with the volcanic rocks, would, when properly polished, be very well adapted for ornamental purposes.

Clays much used in the manufacture of bricks are of frequent occurrence throughout certain portions of the district,

That at the Nebo Road Brickworks, of which not less than eleven feet exist, does not, unfortunately, make bricks which will stand well when exposed to a great heat, owing doubtless to the oxide of iron and carbonate of lime with which this clay is impregnated; the judicious addition of pure siliceous sand might probably remedy this very serious defect.

In Selection 1477A, parish of Abingdon, close to Mirani Station, another deposit of clay exists, the bricks made from which are reported to have stood well when heated in furnaces.

The clay is whitish-yellow, containing nodules of shale, and is ferruginous at the surface—four feet of it are visible.

Calcareous nodules occur in this clay; it appears to dip at an angle of about 5° to W.N.W.

MINES.

Blue-Mountain Copper Mines.

In the parish of Hazledean, on the eastern side of the Pioneer River, and its tributaries, Stockyard and Black Water Holes Creeks, occurs a series of massive-looking hills, the Blue Mountains, culminating in Mount McBryde, some 2,000 feet above the level of the sea.

It is here that a series of veins running, generally speaking, in a N.E. and S.W. direction, traverse the crystalline rocks of which the mountains are made up.

Pine

Pine Vale Copper Mine.

The series of "open works" called by this name are situated in Pine Vale Creek, flowing from the east into the Pioneer River. The lowest workings are at a height of 320 feet above the river, and a passable bridle track has been cut to them through the scrub. The track does not extend to the actual works, owing to the impossibility of horse traffic ever reaching it, the ore being sent across the deep gorge by means of wire ropes.

The "course" or strike of the lode is N.E. and S.W. with an underlie of from 63° to 67° to the S.E. The lode varies in width from 1 foot to 1 foot 3 inches; its matrix is quartz in which malachite, azurite, copper pyrites, and tetrahearite, suphide of copper and antimony, occur in small veins and isolated masses. The "country" rock is granite. On either side of the lode, and on the footwall more particularly, it has been subjected to a considerable amount of alteration, rendering it soft and friable, and is much stained by oxide of iron. In this belt of altered rock occur several interlacing veinlets of quartz stained in places by black oxide of copper. In some of the veinlets the quartz is crystallised, the axes of the crystals being roughly perpendicular to the walls of the vein. In the drusy cavities thus left malachite and a little hematite can be detected.

A gradual passage can in some parts of the lode be traced from the sulphides to the carbonates, and oftentimes in breaking a piece of one of the carbonites a kernel of comparatively unaltered sulphide remains.

The black oxide of copper, Melaconite, is often seen to be merely an alteration product of the copper pyrites.

The copper pyrites, of which the greater visible portion of the lode is made up, shows often a beautiful iridescence on the surface, and it then goes by the name of "peacock" copper.

Both silver and gold have been obtained from this ore; assays made by Mr. Heath, of Rockhampton, gave results varying from 0 to 1 oz. 9 dwts. of gold, 0 to 12 oz. of silver, and 6 per cent. to 40 per cent. of copper per ton.

Thirty-six hundredweight of picked ore sent for treatment to the Victoria Metallurgical Works gave the following results :—

	£	s.	d.
Copper, 270 lbs. at £56 per ton	6	15	0
Silver, 3 oz. 5 dwts., at 4s. per ounce	0	13	2
Gold, 1 oz. 4 dwts., at £4 per ounce	4	16	0
	£12	4	2

Further up the creek, at the foot of a perpendicular precipice some seventy to eighty feet in height, and in the same country, a quartz vein with drusy cavities striking E.N.E., and with a thickness varying from 5 to 7 inches, occurs with an underlie of 60° to 70° to the S.S.E. In the quartzose matrix crystals of galena and masses of copper pyrites occur, and several small veinlets or leaders run in all directions from the vein.

Above this precipice one or two other quartz reefs are met with; some are seen in the bed of the creek which here flows in a narrow gorge with almost vertical walls of great height, having the same course (N. 10° E.) as the reef. One reef has a maximum thickness of 2′ 3″, and is nearly vertical, though no trustworthy measurements of the underlie could be made. No work had been done here at the time the reefs were visited save putting in a stray shot or two. The matrix quartz contained veinlets of copper pyrites, malachite, and here and there a little azurite. Another similar reef higher up the creek has a N. and S. course with an underlie of 86° to the east, and a thickness varying from 6 inches to 1 foot.

O'Brien's Claim.—O'Brien's claim is situated about two miles west of the Pine Vale Mine. A trial shaft 3′ 6″ by 6′ has been sunk to a depth of about 20 feet, but 3 to 4 feet of water had collected at the time the mine was visited. Work first commenced in October, 1888. The reef runs W.S.W. and E.N.E. with an underlie of 84° to W.N.W. The stone at the surface was found to be made up of malachite, azurite, with an ochreous oxide of iron, and a little quartz. Native copper is reported to have been found in the lowest part of the lode, but this could not be verified.

One ton of ore has been sent to Melbourne for treatment, but no returns are yet to hand.

A lode containing in its upper portions as this does the hydrated carbonate of copper will probably yield at a lower depth copper pyrites.

Duffey's Claim.—Duffey's claim taken up as a silver area, is situated on the flanks of the Blue Mountains, at a height of about 1,300 feet above the Pioneer. Here a shaft has been sunk to a depth of 34 feet but no work having been done, and the shaft half full of water, a proper examination of the mine could not be made. The lode runs W.S.W. and E.N.E. The matrix is quartz stained with malachite and azurite; a little iron pyrites and traces of galena are also met with. The "country" is granite. About 3 yards distant a small trial shaft has been put down to a depth of 19 feet, but being full of water nothing could be seen.

Mackay's Claim.—On this claim a shaft situated on the edge of a gully at a height of about 450 feet above the Pioneer has been sunk to a depth of 30 feet from the surface. The lode has an average underlie of 80° to E.N.E. and strikes S.S.E. and N.N.W. with a thickness of about 14 inches. The matrix is quartz in which galena both massive and crystallised occurs together with a little copper pyrites, zinc blende, and malachite. On the hanging wall the decayed "country" rock contains several ramifying leaders of an oxide of iron and a little quartz.

No work has been done here for some time.

An assay of this stone made by Messrs. Coane and Clark is said to have given the following result—pure gold, 3 dwts. 6 grs.; silver, 2 oz. 5 dwts. 17 grs. per ton; lead, 11 per cent.

Kelvin Grove Silver Mines.—Several claims have been laid off as silver areas in the neighbourhood of Kelvin Grove, and a considerable amount of *bonâ fide* work done, but the works have long ago been abandoned. No true reefs existed in any of the mines visited, but only a few "leaders" of quartz and iron glance, rarely a quarter of an inch thick, and not continuous for more than 8 to 9 inches. The

"country" in which the veinlets exist is a rock made up mainly of actinolite and clear and pellucid grains of quartz, and occupies a considerable extent of country, and it is in this belt that all the tunnels have been driven and the shafts sunk.

An assay made from one of the claims, "Bourne's," is reported to have given as much as 4 ounces of silver to the ton.

Qualitative analyses failed to show the presence of silver in a sample of the ore from the mine whence the stone above assayed was taken.

Alligator Creek Mines.—At the time this place was visited no development had taken place, and the only work done was the sinking of a small trench some six inches in depth in which a little ironstained quartz said to contain visible gold had been found. At that time little or nothing was seen which would enable one to judge as to the future prospects of the field. The strata amongst which the recent discoveries have been made consist of a series of bluish-black spotted slates which have a strong resemblance to some of the Gympie beds, and are well seen in the ridges near Selection 1370, parish of Hector.

The blue slaty rocks strike N.N.E. They vary much in their general character, and contain white and red subangular fragments of slate. A fragmental rock with a very rough weathered surface overlies this. It can be traced for a considerable distance down the coast with scarcely any variation in its character. A diorite is intruded through these rocks at one place.

The surface of certain portions of the ground is covered with fragments of quartz stained by an oxide of iron, but in none was any visible gold seen.

The Leaper Claim from which the high assays have been taken, a copy of which is given below, is made up mainly of slates with fragments of quartz lying over the surface, the interstices of which contain perfect crystals of quartz.

A piece of the slate from this claim when subjected to Skey's iodine test failed to show the faintest trace of gold.

The following is a list of assays of stone taken from Leaper's Claim:—

Coane and Clark, Charters Towers—
Gold, 27 oz. 15 dwts. 8 grs. per ton; silver, 2 oz. 16 dwts. 6 grs. per ton.

Sydney Mint—
(1) Gold, 31 oz. 10 dwts.; (2) Gold, 15 oz. 10 dwts.

Peake—
Gold—(1) 10 oz. 16 dwts. 4 grs.; (2) 24 oz. 4 dwts. 12 grs.; (3) 54 oz. 4 dwts. 4 grs.
Silver—(1) 3 oz. 17 dwts.; (2) 5 oz. 14 dwts.; (3) 41 oz. 1 dwt.

Cassell and Co.—
Gold—(1) 6 oz. 4 dwts.; (2) 7 oz.
Silver—(1) 5 oz.; (2) 8 oz. 3 dwts. 4 grs.

Richardson, Habana—
Gold, 72 oz. 13 dwts. 16 grs.; silver, 3 oz. 8 dwts.

Grass Tree Diggings.—Some little excitement was caused by the discovery of a "dark ironstone," which on assay gave as a result from 2 oz. to 4 oz. of gold to the ton at Mount Haden or Grass Tree, situated on the north bank of Cabbage Tree Creek, which empties itself into the sea at the Castrades between Coral Point and Point Victor, and about sixteen miles south-east of Mackay.

The summit of the mountain is 520 feet by aneroid measurement above the level of the sea; its eastern face is apparently made up of diorite which varies greatly in texture, and the rocks in the more immediate neighbourhood are sandstones and shales of the usual coal measure type.

At the time this locality was visited the work done was merely of a prospective character, and no true reef had been discovered.

In one claim, Clyver's, situated on the side of Mount Mary Ann facing Cabbage Tree Creek, a shaft 30 feet deep had been put down, and a level driven a few feet S.E., but the absence of winding gear prevented access to the shaft being obtained; amongst the material brought up, quartz of a bluish-white colour, somewhat cavernous and stained with an oxide of iron, was common. Some of the quartz contained iron pyrites; specimens taken failed to give a prospect, and only a slight trace was obtained with the iodine test. Another claim, held by Muggleton, one of the discoverers of the place, and his party, showed in an open work an indistinct vein of very ferruginous quartz, the interstices of which were filled with a loose earthy lematite and veinlets of limonite. Visible gold was absent from any of the specimens collected, but all by the iodine test showed traces of gold, although only one colour was obtained by the usual method of washing.

In McLean's claim a porous and almost pure white siliceous sinter occurs with veinlets of bluish-white quartz in a long deep trench.

In Atherton's claim a shaft about eighteen feet in depth has been sunk in the hope of meeting with a vein of quartz seen in a cutting on the hill side.

The quartz is bluish-white in colour; specimens on being crushed and washed gave no prospect, and by the iodine test only a faint trace.

The almost entire absence of gold in any of the specimens collected need not necessarily imply its absence in quantities which in the course of future work may prove to be payable; but better results would have been expected had the gold been present in anything like the quantity which the original discoverers anticipated.

Several other reefs occur throughout the district, two of the most promising having been described in a previous report upon the "Geological Features of the Mackay District," but the importance of the others does not justify detailed description being given.

COAL.

Save the bed in Black Rock Creek, in the parish of St. Helens, no other outcrop of coal was seen in the district: the absence of outcrops of coal does not necessarily imply the want of coal beds in the area examined. "The St. Helen's coal contains too much argillaceous and siliceous matter to be of workable quality." ("Geological Features of Mackay," R. L. Jack, 1887.)

The

The intrusion of igneous rocks will tend, however, to have a somewhat deteriorating effect upon the quality of any seams with which they may come in contact.

In order to ascertain or not whether any workable seams of coal or any other minerals of economic value occur, a bore is recommended to be put down near Mirani.

A site in any of the Selections 1477A, 1460, 1461, or 1477, parish of Abingdon, would be not unfavourable both from its position and also from the fact that the rocks have suffered in that region little or no alteration.

Another locality where the indications are such as to warrant the possibility of the discovery of coal beds, and within comparatively easy reach of the town, is comprised in Selections 1100, 911, and 909, parish of Ossa.

The site nearest Mirani is recommended as being the most suitable for the first bore, and in the event of the Bowen Line passing the locality indicated on the Bowen Road a trial could then be made.

Should any workable seams of good quality be discovered within the district an impetus would thereby be given to many of the local industries.

Water Supply.—The average rainfall of the district being about 70 inches, it might not be unnaturally supposed that the water supply would be in a measure proportional thereto, but the physical features, the character of the soil, and the nature of the strata forming the framework of the country have a very important bearing on this point. The drainage area of the Pioneer and its tributaries is triangular in shape and embraces an area of 600 square miles, and the waters drain an area mainly made up of crystalline rocks, whose capacity for absorbing and transmitting water is very low; hence by far the greater portion of the water falling in the area is carried seawards.

The supply from the wells in the district is derived mainly from surface percolation, and, in consequence, is intermittent in character and very liable to pollution. A list of some of the wells from information obtained is given below :—

(1) Well in Portion 110B, parish of Bassett, 2 miles north of Mackay. Information obtained from owner—depth 17 feet; passed through nothing but sand and rock-sand; the level of the water always stands from 3 to 4 feet above the bottom.

(2) Well in Selection 499, parish of Bassett. Total depth of well 48 feet; after passing through a few feet of surface soil the remainder of the well was sunk in diorite, which when exposed to the air weathers into rude spheroidal masses.

(3) Well in Selection 238, parish of Bassett—

Black soil	1′ 6″ inches
Sandy gravel	35′ 6″ „
	37′ 0″ feet.

(4) Well in Selection 661, parish of Abingdon. Total depth 25 feet: after passing through surface soil and shale, altered sandstone was met at 18 feet.

(5) Well in Selection 1147, parish of Hampden—total depth of well 47 feet—

Gravel	7 feet
Whiteclay	7 feet
Shale	1 foot.

Remainder of well argillaceous. Shales somewhat decayed.

(6) Well in selection 1460, parish of Abingdon—total depth of well 57 feet—

Surface soil ... ... 4 feet.

No information as to remainder forthcoming, but from the stone lying round the mouth, the rocks appear to be shales and felspathic sandstones.

(7) Well in Allmuth's Selection, parish of Abingdon.

From information by owner—

Surface soil	4 feet
Shale	20 feet
Sandstone with remains of reed-like plants ...	4 feet.

Total depth 28 feet. In the more immediate neighbourhood of the town the water-level of several of the wells varies in accordance with the daily variation of the tide: this only happens when the wells pass through those thick deposits of sand with which the flats near the sea are fringed.

For an artesian supply of water the geological structure of the Pioneer Basin is not favourable, the rocks not possessing that permeability necessary for the conveyance of underground water.

Omitting all minor details, the stratified rocks may be said to dip at an angle of 5° to the west and impinge upon the granite making up the main mass of the heads of the Pioneer.

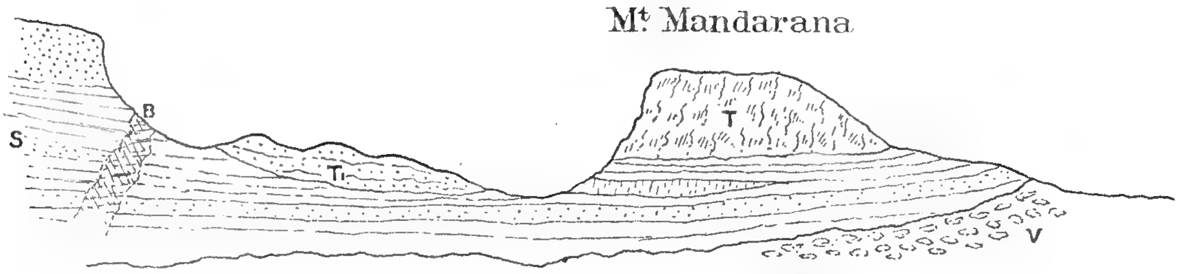
It is, however, within the bounds of possibility that at the junction of the two a certain amount of water may enter the sedimentary rocks and be retained by clayey beds which are known to occur. The bore at Mirani would, if carried deep enough, meet with any that may exist there, but it would not be expected to rise to the surface, and any supply could not be looked upon as at all likely to be continuous or permanent.

Price 1*s.*]

By Authority: JAMES C. BEAL, Government Printer, William street, Brisbane.

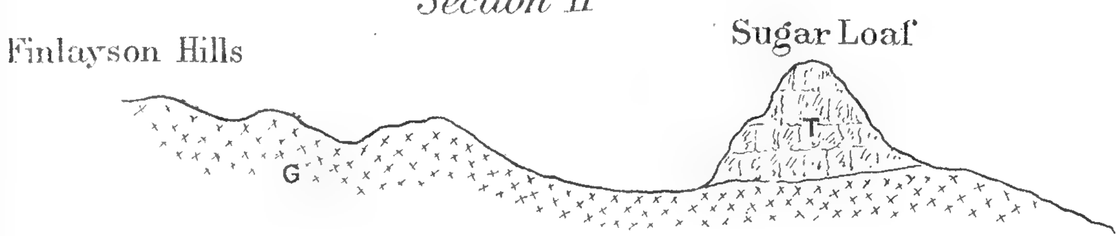
Plate I

Section I



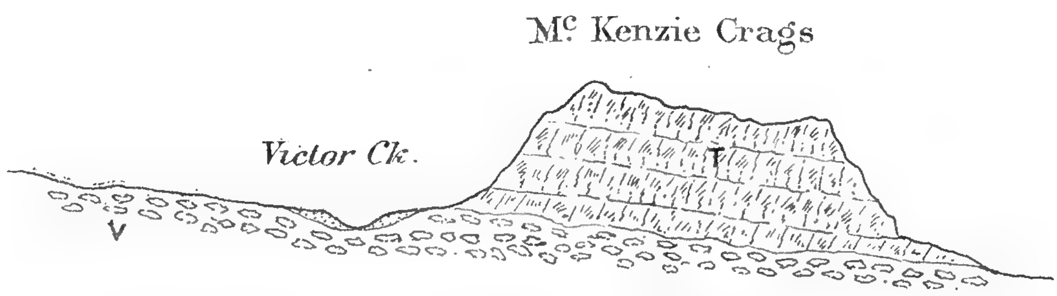
S Sandstones & Shales. B. Basalt. V. Volcanic Series. T. Trachyte Lava. T. Trachyte Ash.

Section II



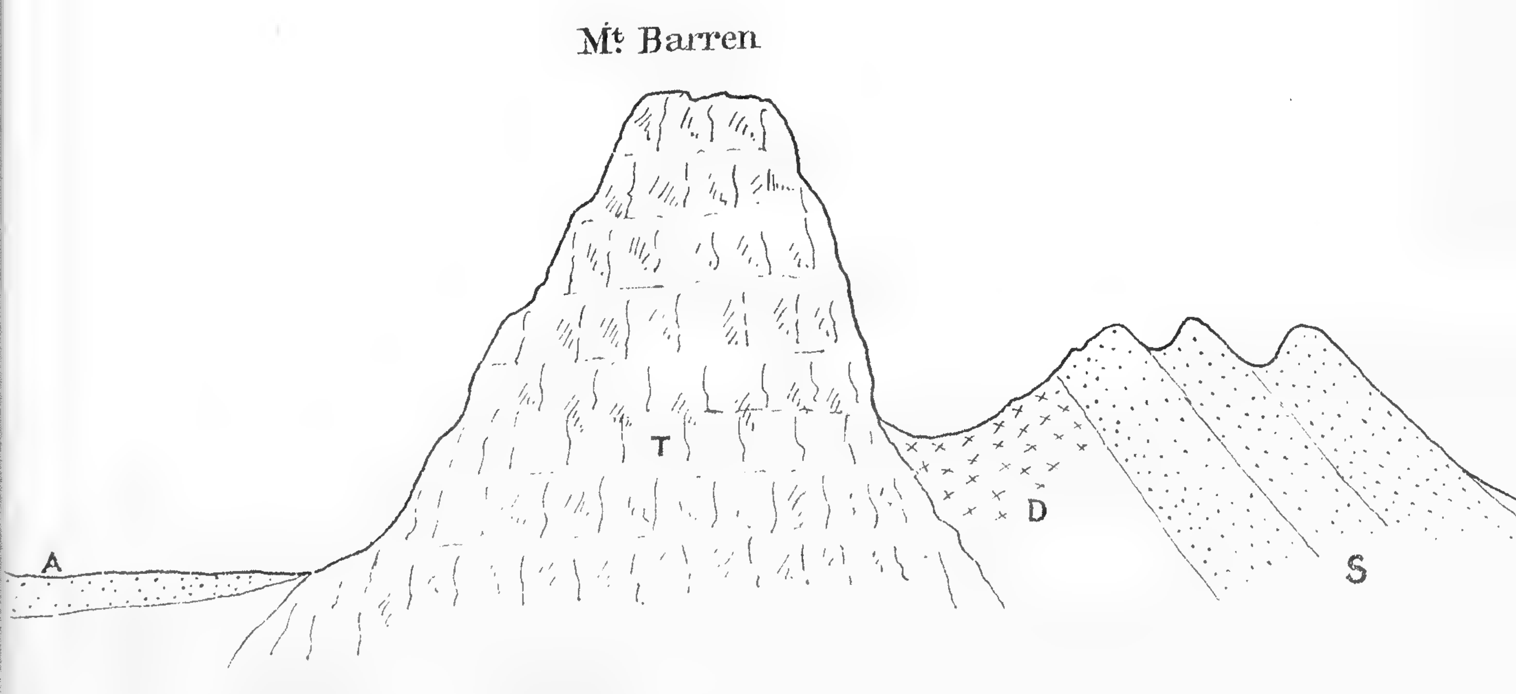
G. Granite. T. Trachyte Lava.

Section III



T. Trachyte Lava. V. Volcanic Series.

Section IV

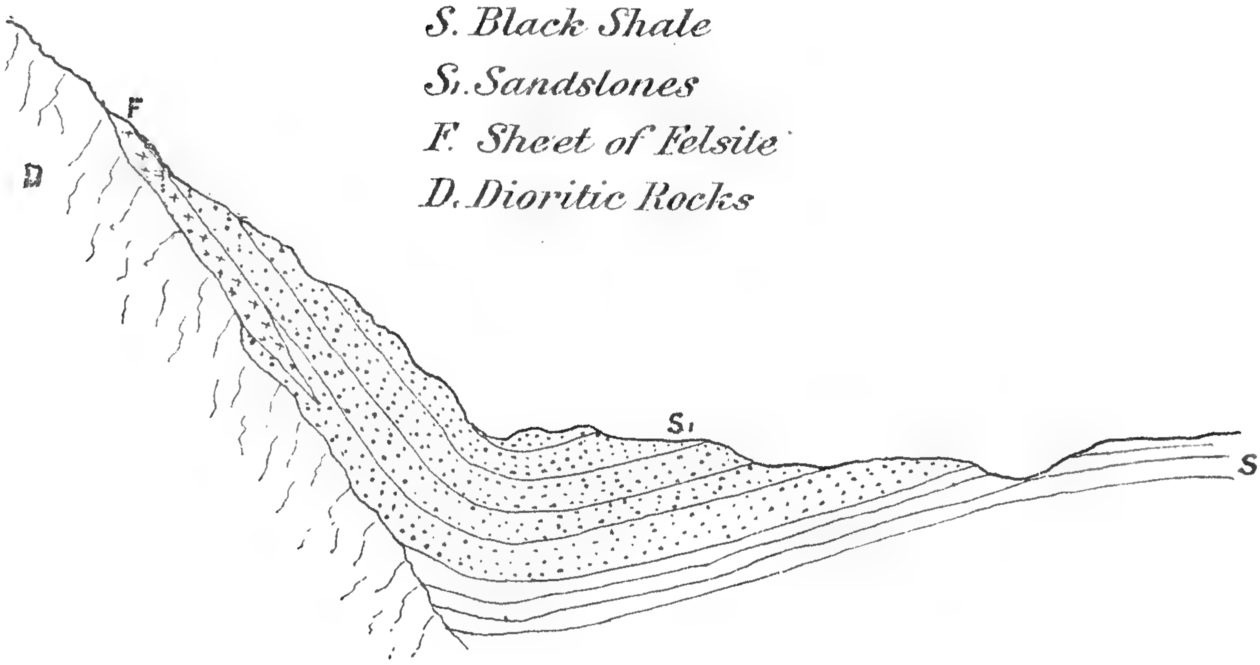


T. Trachyte. O. Orthoclase Porphyry. S. Coarse Grit.
A. Alluvial Flat.

Plate IV

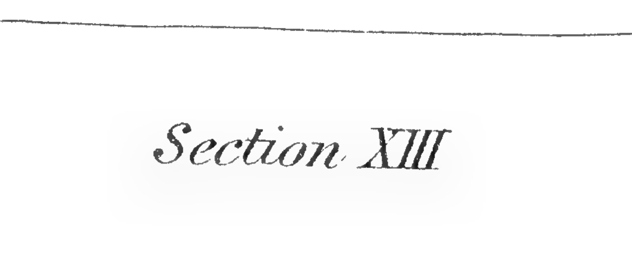
Section XI

S. Black Shale
S₁. Sandstones
F. Sheet of Felsite
D. Dioritic Rocks

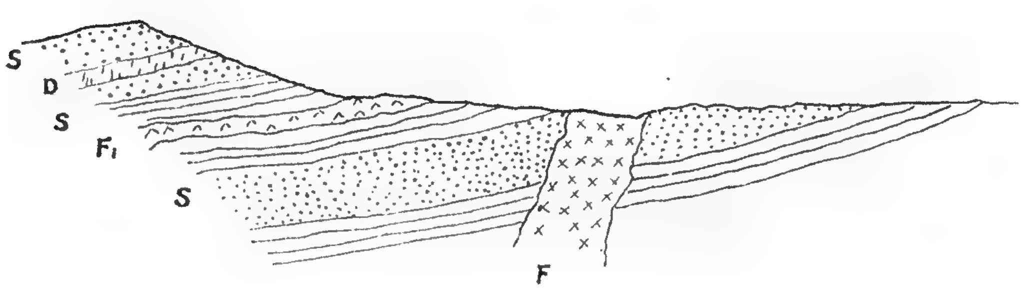


Section XII

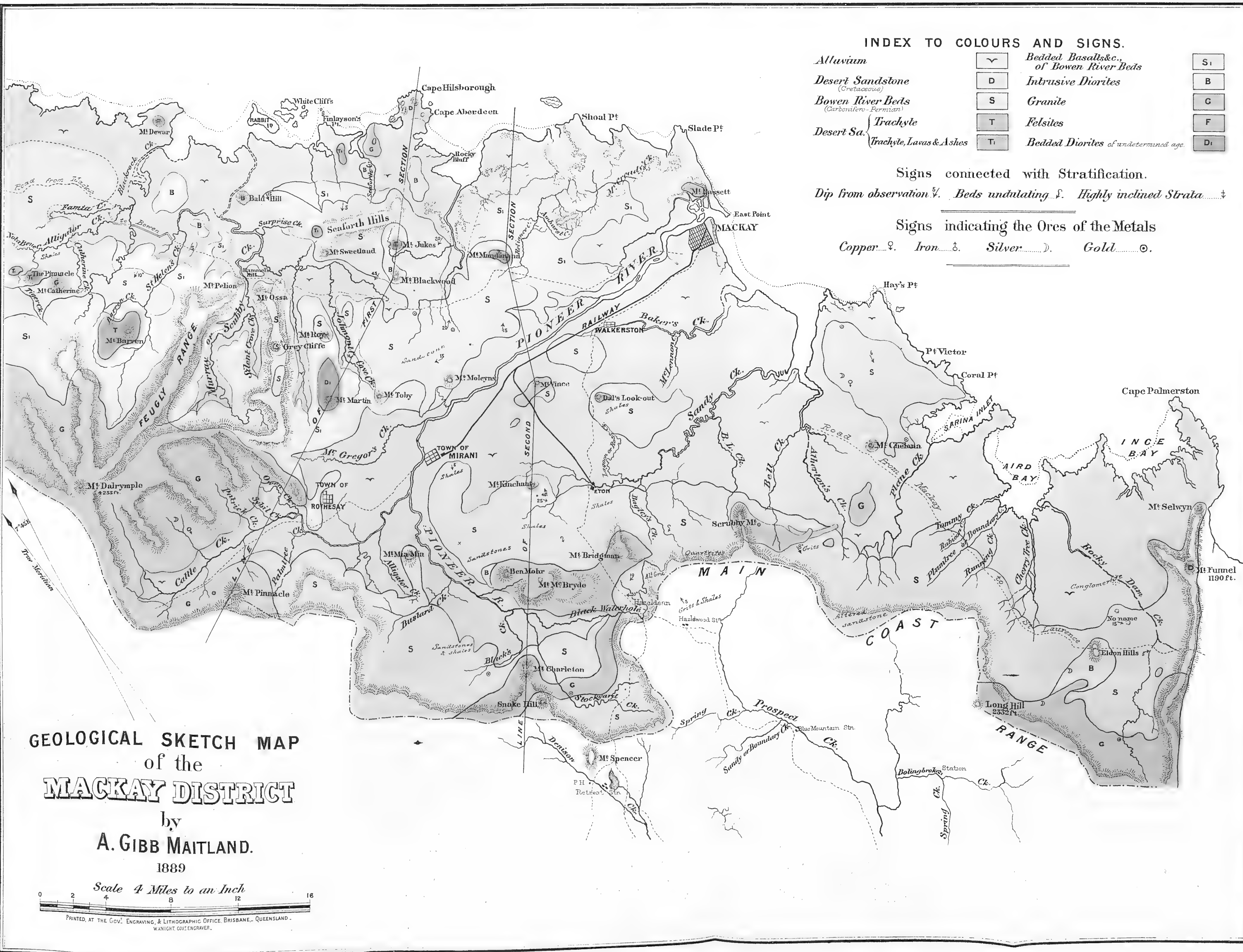
F. Felsite
C. Conglomerate
S. Shale



Section XIII



S. Sandstones & Shales. D. Diorite Sheet.
F. Felsite Dyke. F_1. Felstone Dyke


GEOLOGICAL SKETCH MAP
of the
MACKAY DISTRICT
by
A. GIBB MAITLAND.
1889
Scale 4 Miles to an Inch
0 2 4 8 12 16
PRINTED, AT THE GOVT. ENGRAVING, & LITHOGRAPHIC OFFICE, BRISBANE, QUEENSLAND.
W. KNIGHT, GOVT. ENGRAVER.
INDEX TO COLOURS AND SIGNS.
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Bowen River Beds (Carbonifero-Permian) S
Desert Sa. Trachyte T
Trachyte, Lavas & Ashes T1
Bedded Basalts &c., of Bowen River Beds S1
Intrusive Diorites B
Granite G
Felsites F
Bedded Diorites of undetermined age. D1
Signs connected with Stratification.
Dip from observation
Beds undulating
Highly inclined Strata
Signs indicating the Ores of the Metals
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Cape Aberdeen
White Cliffs
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East Point
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WALKERSTON
Seaforth Hills
Mt Jukes
Mt Blackwood
Mt Mandarana
FIRST SECTION
SECOND SECTION
LINE OF
FEUGLY RANGE
Mt Dalrymple 4255 ft.
Mt Pinnacle
Mt Barren
TOWN OF MIRANI
TOWN OF ROTHESAY
ETON
Mt Kinchant
Ben Mohr
Mt McBryde
Mt Bridgman
Black Waterhole
Mt Charleton
Snake Hill
Mt Spencer
Hazeldean
MAIN COAST RANGE
Prospect Ck.
Hay's Pt
Pt Victor
Coral Pt
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AIRD BAY
INCE BAY
Mt Chelona
Scrubby Mt
Mt Selwyn
Mt Funnel 1190 ft.
Eldon Hills
Long Hill 2332 ft.
True Meridian

1889.

QUEENSLAND.

GEOLOGICAL OBSERVATIONS AT THE HEADS OF THE ISAACS, THE SUTTOR, AND THE BOWEN RIVERS.

(REPORT TO ROBERT L. JACK, ESQ., GOVERNMENT GEOLOGIST, BY ANDREW GIBB MAITLAND, ASSISTANT GEOLOGIST, ON)

Presented to both Houses of Parliament by Command.

After concluding the survey of the Mackay District proper, a few days were spent in packing up the specimens collected for transit to the Survey Museum, for examination and exhibition, preparatory to proceeding to visit "lands on the Western side of the range not previously reported on" by the Government Geologist, in accordance with instructions received in the early part of February, 1889. The localities proposed to be visited were the Eungella or Bee Creek Diggings, the Mount Gotthard Copper Mines, and the silver discoveries at Emu Plains, together with a traverse from Lake Elphinstone to Byerwin, "with the object of ascertaining the relations of the coal measures at these two place to one another."

Hazlewood Station, first reached by an easy road after leaving Eton, is about two and a half miles S.E. from the township of Hazledean, at the summit of the main range, and at a height of about 700 feet above sea level. Where the road crosses the range a coarse grit and fine conglomerate are seen in the cuttings along the roadside. Near the head station an altered felspathic sandstone is seen in a quarry, and on a ridge above the lagoon, on the bank of which the house is situated; nothing, however, was seen to indicate its dip or direction. In places the rock assumes, when freshly broken, the appearance of some quartz felsites, but its weathered surface would seem to indicate its elastic character.

In a gully flowing past the head station a felsitic rock is seen near its head. It lies approximately horizontal, or with but a slight dip to the south. From its being somewhat vesicular, it is doubtless a lava flow; the rocks amongst which it lies are sandstones and grits. At the head of this gully a gap, 280 feet above the station, is found to be capped on either flank with a medium-grained grit, which in a creek flowing south of the divide is seen to be underlain by black shale, which dips at an angle of 5° to N. 20° W.

Among these rocks an intrusive sheet of dolerite occurs.

The rocks here are a continuation of those seen in the gorge at the back of Oakenden and in Black Waterholes Creek.

Leaving the station several black-soil alluvial flats were crossed over until the Nebo road was joined, near Selection 1,411, Parish of Hazledean. Before reaching the main road a dyke of basalt was seen to intrude through the sedimentary strata at the end of a large waterhole.

On the Mount Spencer road several exposures of a metamorphosed diorite are seen, and at one place, not far from the Telegraph crossing, a horizontal bed of a recent calcareous and ferruginous sandstone is laid bare. Where the Nebo road crosses Denison Creek, at the public-house at Mount Spencer, in the bed of the creek a fine-grained diorite is seen to be pierced by a dyke of hornblendic granite, in which several small masses, and sub-angular nodules of diorite occur. At the crossing of the next creek a recent breccia is seen to overlie a porphyritic diorite.

From Nebo to Tongwarry dolerite and hard sandstones are seen at intervals along the road; whilst from that place to Mount Britton the road passes over black-soil downs. Few sections are seen save buff-coloured shales and diorite in the bed of a dry gully in Cooper's Creek, and fine-grained grey calcareous sandstones and greyish shale of coal measure type.

In the "Report upon the Geological Features of the Mackay District," of November, 1887, by Mr. R. L. Jack, it is stated that "The higher hills to the east of the township of Mount Britton, are capped by a nearly horizontal deposit of volcanic ash . . . . made up of very fine dust, apparently the *debris* of a highly silicated porphyry, of which occasional large fragments occur in it." Time did not allow any lengthened time to be spent upon this point; but an examination of a cliff about a mile to the south of the township clearly showed that this bluff was made up of lava flows, the case having that characteristic structure, common to many lavas, of being full of sub-angular fragments of itself, due to the rapid cooling of the mass, and over which the molten matter subsequently flowed.

Throughout, the rock is very homogeneous in character, being in places very finely banded, and containing porphyritic crystals of sanidine, and showing to the unaided eye distinct fluxion structure, the lines of flow being often seen to bend round the larger crystals. The finely banded structure, and the presence of crystals embedded in the rock would not prevent its being a volcanic ash, but the presence of fluxion structure would seem to indicate that portions of this mass have flowed out over the surface in a viscid condition. No ash beds were seen in this section. From

From Mount Britton my route took me *viâ* Plevna to Eungella Station by a narrow bridle track, over ranges whose highest point is 2,000 feet above the level of the plains, and made up of sedimentary rocks with intrusive and contemporaneous sheets and dykes of basic rocks. From Eungella Station to Bee Creek the distance is about eight miles east, over very high and rugged mountains little short of 3,000 feet above the level of the sea.

THE BEE CREEK OR EUNGELLA DIGGINGS.

The Bee Creek diggings (*see* Map attached) are situated in the area drained by the waters of the creek of that name, one of the main tributaries of the Broken River, and are distant about sixty miles due west of the town of Mackay.

Being entirely hemmed in by steep precipitous mountains, access to the field is obtained by routes which no constructive ingenuity can render easy without the judicious expenditure of a considerable amount of money.

One route from Mirani passes up the banks of Cattle Creek for a distance of about twenty miles by a beaten track, well suited for vehicular traffic. From a point at a height of 228 feet above sea level, a track has been cut through the scrub up a razorback which in a horizontal distance of less than a quarter of a mile ascends to a height of 1,997 feet above sea level, and thence to the township a descent of about 600 feet is made by a bridle track, of which about four miles has been cut through scrub.

Another route from Mirani crosses the range by a track known as Armstrong's. This has the disadvantage of having to cross two ranges instead of one, both of which are at a considerable elevation above sea level.*

The area drained by the Bee Creek water is practically all granite, which shows only that amount of variability in structure and composition which is common to different parts of the same rock mass; it appears fine in grain near the outskirts of the mass; generally it is medium in grain, and grey in colour with quartz felspar and biolite replacing, and sometimes accompanying, hornblende. Instances are not rare in which the rock assumes a pseudoporphyritic structure.

At the junction of Bee Creek with the Broken River the granite appears to be intrusive through quartzose rocks, which have the appearance of very metamorphosed stratified rocks; about 100 yards below the junction a bed of altered conglomerate occurs among the granites and felsitic rocks, which here make up the bed of the creek. At a point in the Broken River some little distance above its junction with Bee Creek, a mass of schistose felsite is seen associated with the quartzose rocks. Numerous segregation veins of quartz, some of great thickness, occur at intervals through the field.

As to the age of these rocks, no direct evidence is at present forthcoming. They bear a resemblance to those occurring in the Clarke Tableland near Normanby, though perhaps the alteration has hardly proceeded to such an extent as at the latter places. Doubtless a systematic examination of the Broken River and its tributaries would yield evidence of some value upon this point, as for some considerable distance these creeks lay bare excellent sections of the strata.

Dolerite dykes occur in the granite. These are younger than some of the reefs, for in places they are seen to cut through them.

The accompanying map shows the geological features of the district, but the absence of a proper survey prevents the position of the various lines of reef being laid down.

Highland Mary P. C.—In this claim a shaft has been sunk on the underlay for a vertical distance of 45 feet. At the foot the thickness of the reef varies from $6\frac{1}{2}$ to $10\frac{1}{2}$ inches, with an average underlie of 65° to the south, and a course of N. 80° E. The matrix of the reef is ferruginous quartz, containing a little galena, iron pyrites, and stains of the green carbonate of copper. In those portions of the country which are in contact with the reef, a thin sahlband of nearly pure white quartz of no great thickness, occurs highly charged with iron pyrites. The country rock is a grey granite, medium in grain.

Highland Mary No. 1 *East.*—Here a vertical shaft, 6 feet by 4 feet has been sunk to a depth of 50 feet, and timbered to a depth of 31 feet from the surface. The reef is mainly mullock, 12 inches in thickness, and apparently increasing. It dips at 80° to 85° to the S. 15° W., and strikes N. 15° E.

Coral Tree P.C.—In the Coral Tree line of reef a shaft 6 feet by 4 feet has been sunk to a depth of 47 feet. At the bottom a similar leader of quartz, about an inch in thickness, dips at an angle of 80° to 90° to S. 20° E., and strikes N. 80° E. Above this the reef had a thickness varying from 18 to 20 inches. The matrix of the reef is quartz, containing iron pyrites, zinc blende, and a little galena. The country rock is a close grained grey granite.

Coral Tree No. 1. *West.*—A small shaft 5 feet by 4 feet has been sunk to a depth of about 10 feet. No reef is visible in the shaft, but two small quartz leaders from $\frac{1}{4}$ inch to 1 inch in thickness are seen. The quartz is somewhat ferruginous. The average "strike" of the leaders is N. 75° E., the dip of the northernmost being 70° to S. 15° E., whilst of the southern is from 80° to 85° to S. 15° E. At the surface the width between them is 20 inches, which at the foot decreases to 12 inches. The country is decomposed granite.

Eureka Reef.—A small underlie shaft sunk for a distance of 20 feet, in which a quartz reef varying in thickness from 4 to 6 inches is seen to dip at an angle of 45° to 50° to S. 25° E. and having a course of N. 65° E. Both walls are granite, much decomposed.

Coral Tree, No. 1 *East.*—A small trial shaft has been sunk to a depth of about 10 feet, in which a thin vein of ferruginous quartz having a width of about 3 inches, but which pinches out near the bottom, is met with. The dip of the vein is 80° to N. 75° E. An assay by Mr. Richardson, of Habana, gave 4 oz. of gold per ton as a result. On the hanging wall a thin gangue of clay is associated with the quartz. The country rock is granite.

Broken River Gold and Silver Prospecting Company's Claims, No. 1 *Silver Lease.*—In this claim a shaft 8 feet by 4 feet has been sunk to a depth of 65 feet. At the foot the thickness of the reef varies from 4 to 6 inches, while at the surface its thickness is said to be 1 foot. The greatest thickness was attained at a depth of about 25 feet, when it was 2 feet 6 inches. The average dip is from 70° to 75° to N. 50° E., its course being N. 30° W. At a depth of 55 feet the reef pinched out to about 1 inch in thickness. The matrix of the reef is quartz stained with an oxide of iron, and containing

iron

* The much longer route by Mount Britton and Blenheim's has, after leaving Eungella Station, to cross a spur from the main range, whose highest point is 3,000 feet above sea level.

iron pyrites and strings of galena, which in one place attain a thickness of from 2 to 3 inches. An assay made from stone taken at the surface is reported to have given as a result:—Gold 1oz., and silver from 60 to 70 oz. per ton. This reef can be seen cropping out on a spur a little distance from the main shaft. The country rock is grey granite.

No. 2 Silver Lease.—A small trial shaft has been sunk on this claim to a depth of 8 feet, at the bottom of which a fairly well defined reef about 10 inches in thickness, dipping at 60° to 65° to S. 45° E., and striking N. 50° E. The matrix is quartz, containing a little iron pyrites. The country is decomposed granite.

Junction P.C.—Here a small shaft has been sunk to a depth of 9 feet, in which as yet no true reef has been met with, but a "mullocky" leader running N.E. and S.W., and containing in places a little ferruginous quartz in which no gold is visible. A little distance to the south another small shaft about 8 feet deep has been sunk, in which a similar "mullocky" leader was met with, an assay of specimens from which is said to have given as a result, 2oz. of gold and 5oz. of silver to the ton.

Golden Crown.—A shaft 6 feet by 4 feet has been sunk to a depth by aneroid measurement of 45 feet. In the shaft a reef dipping at 70° to 80° south, and striking east and west has been met with. The matrix of the reef is quartz, containing a little iron pyrites. The average width of the reef is 4 inches. An assay gave, as a result, 2dwts. of gold per ton From this reef payable gold was reported.

Phœnix Claims.—The reef in this claim is in the same line as that of the Golden Crown A shaft 6 feet by 4 feet, sunk to a depth of 22 feet, met with a leader of quartz running east and west, and dipping at 75° to the south. The leader, 3 inches thick, was composed of ferruginous quartz, containing a little iron pyrites. Country granite.

Annie Claim.—This claim is situated on a spur 500 feet above Bee Creek A shaft sunk to a depth of 10 feet met with a reef 18 inches in thickness, dipping at 88° to the S.E., and running N.E. and S.W. The matrix of the reef is quartz, with an ochreous gangue of clay on either wall. Good prospects were obtainable from this claim. The country rock is grey granite.

Queen Reef is situated on one of the branches of the main creek, and at a height of 320 feet above it. An underlie shaft has been sunk to a depth of 10 feet. A reef 2 to 3 inches in thickness underlying at 55-60° to S. 40° W., and striking N. 50° E. was met with. The matrix of the reef is quartz, somewhat ferruginous and cavernous, and containing iron pyrites. Very good prospects were obtained from this reef.

Martin's Reef.—A small trial shaft has been sunk upon a small leader 5 inches thick of very ferruginous quartz, containing a little fine gold. The leader dips at 85° to the South, and strikes S. 45° E. Some little distance north-west of the above another small shaft has been sunk to a depth of about 9 feet on a quartz reef 6 inches in thickness, underlying at angles varying from 75° to 85° to S. 30° E. and striking N. 60° W. The quartz contains a large quantity of galena, said to have assayed as much as 70 oz. of silver per ton.

Lady Norman Reef.—A very promising reef is situated on the left bank of the Broken River, near its head, and about ten miles south of the Bee Creek diggings. The position of the reef is on the summit of a ridge 520 feet above Eungella Station. Two trenches have been dug across the ridge, and in both the reef was met with. The underlie is 80° to N. 80° W. with a course of N. 25° E. The thickness visible was 2 feet, and the matrix ferruginous quartz, containing a little iron pyrites. The hanging wall is a somewhat altered sandstone, and the foot wall a diorite. Visible gold was present in some of the specimens collected, whilst nearly the whole of those crushed and washed yielded fairly good prospects.

A little alluvial gold is reported to have been obtained in several of the gullies forming the heads of Bee Creek, but nothing of a payable nature.

Specimens collected from nearly the whole of the Bee Creek mines gave fair prospects when washed, and none showed any visible gold. The gold was very fine, and somewhat pale in colour, due probably to the presence of silver.

The work done at the time the diggings were visited had not gone beyond the prospecting stage, hence perhaps it may be a little early in its history to venture a forecast as to its future development. Its comparative inaccessibility, however, will have a somewhat retarding effect upon its progress.

Leaving Bee Creek diggings *en route* for Eungella Station very fine grained granite was passed over, and a very silicious rock, not unlike an altered fine grained sandstone, was seen on the hill slopes facing west. To the east of the head station a rock having the appearance of an altered volcanic ash is seen in situ; it lies horizontally, and its weathered surface shows its fragmental character.

Leaving the station a visit was paid to Mount Barker where a silver-bearing galena lode had been discovered.

A shaft 3 feet by 6 feet had been sunk to a total depth of 80 feet. At 30 feet a level had been driven across the reef which here underlies at an angle of 65° to 70° to S. 25° E. The lode is 3 feet 3 inches thick, with a matrix of quartz, in which galena, zinc blende, and copper pyrites occur. At 60 feet another level had been driven, and the lode was 3 feet 8 inches thick, and some of the leaders contained carbonate of zinc.

It is intended to put in another drive, at a depth of 100 feet, to meet the lode.

At the surface the outcrop can be traced for some distance, and bears N. 35° E. It contains the blue and green carbonates of copper, and also carbonate of lead.

An essay of the ore from the 60 foot level, is said to have given 75 per cent of lead, 57 oz. of silver to the ton, and a trace of antimony.

Several trenches have been dug in which the lode has been met with, but beyond this no further work has been done.

The road from Eungella to Plevna Station passed over sandstones and shales, with associated basic igneous rocks, probably the equivalents of the Bowen River beds. From Plevna the route lies over a steep range, composed of alternations of slates and ferruginous sandstones, with intrusive dioritic rocks.

Low down a spur, near one of the heads of Oakey Creek, horizontal buff and black sandy micaceous shales occur, which yielded no fossils. Some distance from the "Stalk," a peak on the divide between the Fitzroy and the Burdekin, a well-marked bedded rock was seen at a distance to be dipping away from it, the rock looked not unlike a bed of lava or ash, whose source was the Stalk.

At several places on the way down the spur large blocks of agglomerate, made up apparently of trachytic materials, were met with.

After

After passing Mount Robert, the flats between Oakey Creek and the heads of Cooper's Creek are underlain by sandstones and shales, seen to dip in places at low angles to N. 45° E.

The flats between Cooper's and Hail Creeks are made up of comparatively unaltered sandstones and shales which dip at angles from 3° to 5° to the west. These yielded no fossils, but fragments of silicified wood are strewn all over the soil.

In places coarse, massive, and conglomeratic sandstones with silicified wood, are seen dipping at angles of 10° to N. 45° E. In the banks of Bee Creek, near to where it is crossed by the road from Fort Cooper to Lake Elphinstone, sandstones and buff coloured shales dipping west at 0·15 W. are met with on both banks. An escarpment on the south side of the road runs N. and S., and is made up of felspathic sandstones, dipping at 5° to the south. The road heads the escarpment near Lake Elphinstone, at a height of about 1,050 feet above sea level.

The geological features of the country at the head of the Isaacs are shown upon the accompanying map, the topography being taken from a map courteously placed at my disposal by Mr. Bridgman, of Lake Elphinstone.

The Isaacs (*see* Geological Sketch Map attached), one of the main tributaries of the Fitzroy, rises on the dip slope of a nearly level bed of sandstone, and then eats its way through a lofty sandstone range—the Carborough Range—whose highest point is 700 feet above the level of the surrounding country.

The narrow gorge through which the Isaacs flows is the one known as the Leichhardt Gorge, up which the Leichhardt expedition from Moreton Bay to Port Essington passed on March 7th, 1845.

On the existing maps the divide between Eaglefield Creek, one of the branches of the Suttor, and the Isaacs is marked as a conspicuous range of mountains—the Denham Range—but in reality no such range exists here, the water parting being merely a scarcely perceptible rise in the midst of blacksoil downs.

Lake Elphinstone is drained by a creek—Anna Creek—which joins the Isaacs about seven miles below the lake, and the tableland upon which the lake rests overlooks the Fort Cooper waters which join the Isaacs about eighty miles to the south. These waters rise at a considerably lower level than those of the Isaacs proper.

The Carborough Range is composed of a series of conglomerates, grits and sandstones, about 500 feet in thickness, which are arranged in a series of synclinal troughs, whose longer axes run generally N.W. to S.E. The base consists of a coarse, somewhat felspathic grit, dipping at angles from 7° to 9° to S. 10 W. The upper portion being much finer in grain, and made up of a fairly fine grained ferruginous sandstone.

Beneath these beds the Upper or Freshwater series of the Bowen River beds are observable.

At a waterfall in Bee Creek, some distance north of the station, fine-grained sandstones are seen lying upon sandy micaceous shales, containing plants—*glossopteris* and *sphenopteris* (?). A few yards up the creek an impure coal, one foot in thickness, with a seat earth about three feet thick, is seen to be overlain by a grit with a pebbly base, and dipping at 10 North.

One of the tributaries of Bee Creek exposes a seam of coal with thin bands of carbonaceous shale bands: six feet of the coal only are visible; it dips at a low angle to the north.

The coal measures have undergone a little disturbance, for several faults are visible in the water-courses, but no faults with a very large down throw were met with.

Some eight miles distance N.E. from Lake Elphinstone Station the Mount Gotthard Copper Mines are situated; actual work ceased about ten years ago. Access to the workings could not be obtained owing to their having fallen in, nor was anything lying around the mouths of the disused shafts to indicate the nature of the ores obtained.

The workings are situated amongst a series of buff-coloured hard slates dipping at angles of 45° to 47° to N. 75° W. These yielded no fossils.

The slates form an anticlinal-fold, whose longer axis runs approximately north-east and south-west. From what exposures were visible, their difference in character and hardness to those of the coal measures seems to indicate that they are much older; no sections showed the coal measures lying directly upon them.

Down Anna Creek, after passing through the gorge formed by Anna Creek, black-soil and sandy flats are passed over, but no section of the underlying strata is seen.

Further down the Isaacs, before it is joined by Skull Creek, almost level beds of sandstone are seen at intervals in the numerous gullies flowing into the main watercourse.

About three miles west of Lenten Downs Station a bed of coal, two feet in thickness and of fair quality, was met with in sinking a well about fifty feet in depth.

From Lenten Downs to Greendale, on the Eaglefield Creek, black-soil and sandy flats, with occasional outcrops of sandstone, are passed over. A well sunk to a depth of seventy feet, passed through a seam of coal similar to that near Lenten Downs. Doubtless they are the same bed.

Near the head of Hill's Creek, a sandstone (carb? or rolling down?) is exposed in several places; it is overlaid by a soft ferruginous and cavernous sandstone and conglomerate, made up of pebbles, and the Carbonifero Permian type.

In one place it rests directly upon a basalt, as to the age of which no evidence is forthcoming.

On the eastern side of the road from the lake to Mount Illalong a small knob of coarse basalt rises to a height of about forty feet above the surrounding country; it is younger than the desert sandstone.

Some distance northwards, and on the western side of the road, a small hill, Mount Swan, is seen to be made up of basalt, much finer in grain than that forming the knob mentioned above.

Sandstone overlying buff-coloured shales is seen at intervals along the road from the Lake to Mount Illalong Station.

The sandstone upon which the Lake rests is doubtless the one seen along the road.

From Mount Illalong Station my route followed Suttor Creek for a distance of about four miles. At intervals in the bed of the creek, and in places where the thin covering of surface soil had been washed away, a greenish-grey felspathic sandstone is seen to lie horizontally; it bears a strong resemblance to the lake sandstone. This can be traced for a considerable distance towards Byerwin. In a creek rising in the Redcliffe Range, and flowing south-west the sandstone, dips at from 3° to 5° to S. 20° E.

At

At intervals along the road small mounds or cakes of vesicular basalt, about 2 feet 6 inches in height, are met with. Nothing was seen which threw any light on their origin.

Black-soil flats, and occasionally sandy-soil flats with sandstones are seen until a hill with a bedded basalt overlain by beds of black shale is met with.

Below Byerwin Head Station, which is situated on the western bank of Cerito Creek, a series of felspathic sandstones and conglomeratic grits are seen dipping at a low angle to the west.

From the station to a conspicuous hill—The Commissioner—grits occasionally crop out. The Commissioner, 440 feet above the station, is made up of a vesicular basalt, which appears to be unconformably upon the underlying rocks.

From this point my route lay in a general N.W. direction. In crossing the bed of an oaky creek a felspathic sandstone, underlain by an impure coal with a sandy seat earth, dips at angles varying from 15° to 20° to W. 10° S.

From the summit of a basalt hill near this point, seven other hills similar in shape could be counted. Whether they were all of basalt, time did not allow of ascertaining.

A watercourse to the north-west of this point showed a fine-grained felspathic sandstone, dipping 20° to 25° to S. 35° W.

On the western bank of Kangaroo Creek, near an old stockyard, greenish-grey felspathic sandstones dip at 10° to 15° to S. 15° E., and are intersected by an intrusive dolerite.

Near the head of Rosella Creek the stratified character of the beds forming Mount Leslie is well seen, and from boulders in the watercourses taking their rise from it, the mountain is evidently made up of sandstones, grits, and conglomerates similar to those forming the Carborough Range, of which, physically, it is a continuation.

Where Rosella Creek rounds Mount Leslie, a pebbly sandstone is seen to dip at 10° to 12° to the West. Further south-east an interbedded dolerite is seen cropping out on a low ridge.

In the bed of the Bowen River, near Blenheim Station, sandstones and shales are seen dipping south-west.

Between this point and Mount Leslie, in some of the gullies traversing the black-soil flats, a felspathic sandstone, with an underlying impure coal, is seen to dip at an angle of about 5° to the west.

At a series of rapids in the bed of the river a little below Blenheim Station, sandstones dipping at 25° to S.W., with ironstone nodules, and remains of silicified wood, are seen to be traversed by a dyke of diorite, 4 feet 6 inches thick, running S. 70 W., and underlying at 80° to S. 30 E. The beds on either side of the dyke are slightly hardened. In isolated places some of these beds contain nodules of coal, and buff-coloured shale. Below the above sandstones ten to twelve feet of sandy shale are seen resting on beds of grit, which dip at 15° to S.W. About three miles below this, and on the Eastern bank, after passing a black-soil alluvial flat, a conspicuous ridge made up of coarse grit, dipping at 15° to 20° to S. 45° W., crosses the road. The beds exposed in it belong to the middle series of the Bowen River beds; overlying it are black shales, seen some distance down the road.

A thick sheet of porphyrite, with a conspicuous escarpment to the east, probably represents the Trappean series. It is full of nodules of chalcedony.

In Exmoor Creek intensely altered sandstones and shales dip at 65° to S. 55° W. They are pierced by an intrusive basic rock. A somewhat similar succession is seen in the Bowen River, below Tent Hill. All that can be said of the rocks is that they are certainly precarboniferous. They bear a striking likeness to those seen at the junction of Bee Creek and the Bowen River. One noticeable feature regarding the strata described above, is the comparatively little alteration which they have undergone as one recedes from the main coast range.

By this circumstance the possibility of the future development of the Nebo coal-field is assured; though, perhaps, the day has hardly yet arrived for the working of the field to be remunerative.

EMU PLAINS SILVER FIELD.

At Emu Plains on the eastern bank of the Bowen River, and about $3\frac{1}{2}$ miles north-east of Emu Plains Station (*see* Plan attached), the mines in which a copper ore containing a very high percentage of silver has been discovered, are situated.

The strata amongst which these discoveries have been made are metamorphic crystalline rocks, the relations of which have not been satisfactorily worked out. All that can at present be said of their age is that they are pre-carbonifero permian.

Several shafts have been sunk to depths varying from thirty to fifty feet, but the work can hardly be said to have gone beyond prospecting. In none of the mines was any lode, in the true sense of the word, met with. The richest portions, those from which the high assays are made, occurred in thin veinlets of variable thickness and no great extent; these, so far as work has at present gone, were much more plentiful near the surface. The ore obtained is said to have given on assay results varying from 300 to 8,000 oz. of silver per ton, and a bulk assay from picked ore is reported to have given as a result 1,600 oz. of silver to the ton.

Only a very small percentage of the ores examined contained the tetrahedrite (fahl ore), from which the silver has been obtained. The greater portion of the veinlets is made up of the blue carbonate of copper, associated with which, in places, is the green carbonate. The blue carbonate of copper is apparently an alteration product of the fahl ore, for in places a nearly gradual passage can be traced from the one to the other. In neither the blue nor the green carbonates was any silver detected, but the tetrahedrite was found to contain silver in large quantities.

Carbonate of lime is associated in many places with the azurite (blue carbonate of copper). In the fahl ore a small percentage of gangue, mainly quartz, not unfrequently occurs.

With the exception of a small quantity of tetrahedrite in a leader just met with at the foot of King Solomon II, none other was met with, though in most of the shafts stains and little nests of azurite were seen.

In all the work hitherto done the main object has been to discover those patches in which the "blue ore" is most common; experience having shown that the richest portions are those in which the "blue ore" predominates.

The

The irregular and erratic mode of occurrence of the ores is much to be regretted. The presence of the carbonates of copper at the surface seem to be due to the decomposition of the sulphides, would seem to imply that if any lode were met with it would be a sulphide, but whether copper pyrites or tetrahedrite one cannot say. That the blue carbonate of copper is due to the decomposition of the sulphide of copper and antimony specimens collected show.

The ramifying leaders occurring in the various shafts may lead to deposits of argentiferous copper containing a sufficiently high percentage to render the working remunerative. The high results reputed to have given by assay and treatment, are sufficient to warrant a fair trial being given to those mines from which the ore giving the best results have been obtained.

The accompanying plan shows the position of the various claims taken up as silver leases.

Leaving the silver mines at Emu Plains, my route to Bowen lay *viâ* Sonoma Station, ere reaching which the middle and upper series of the Bowen River beds were passed over. From Sonoma Station the track follows Pelican Creek, on the banks of which at an old sheep station, sandstones and shales were seen; from this point up the creek to a low pass on the divide between the waters of Pelican Creek and the Bogie. The series of bedded basalts and pophyrites with the underlying sandstones forming the lower series of the coalfield were passed over.

After crossing the Clarke range, the Bogie River was followed down to Mount Pleasant Station, exposures at intervals showing the prevailing rock to be a granite of a greyish yellow hue, upon the uneven surface of which the Bowen River beds were laid down.

At this point actual field work terminated, and a rapid journey to Bowen was undertaken.

Price 9d.]

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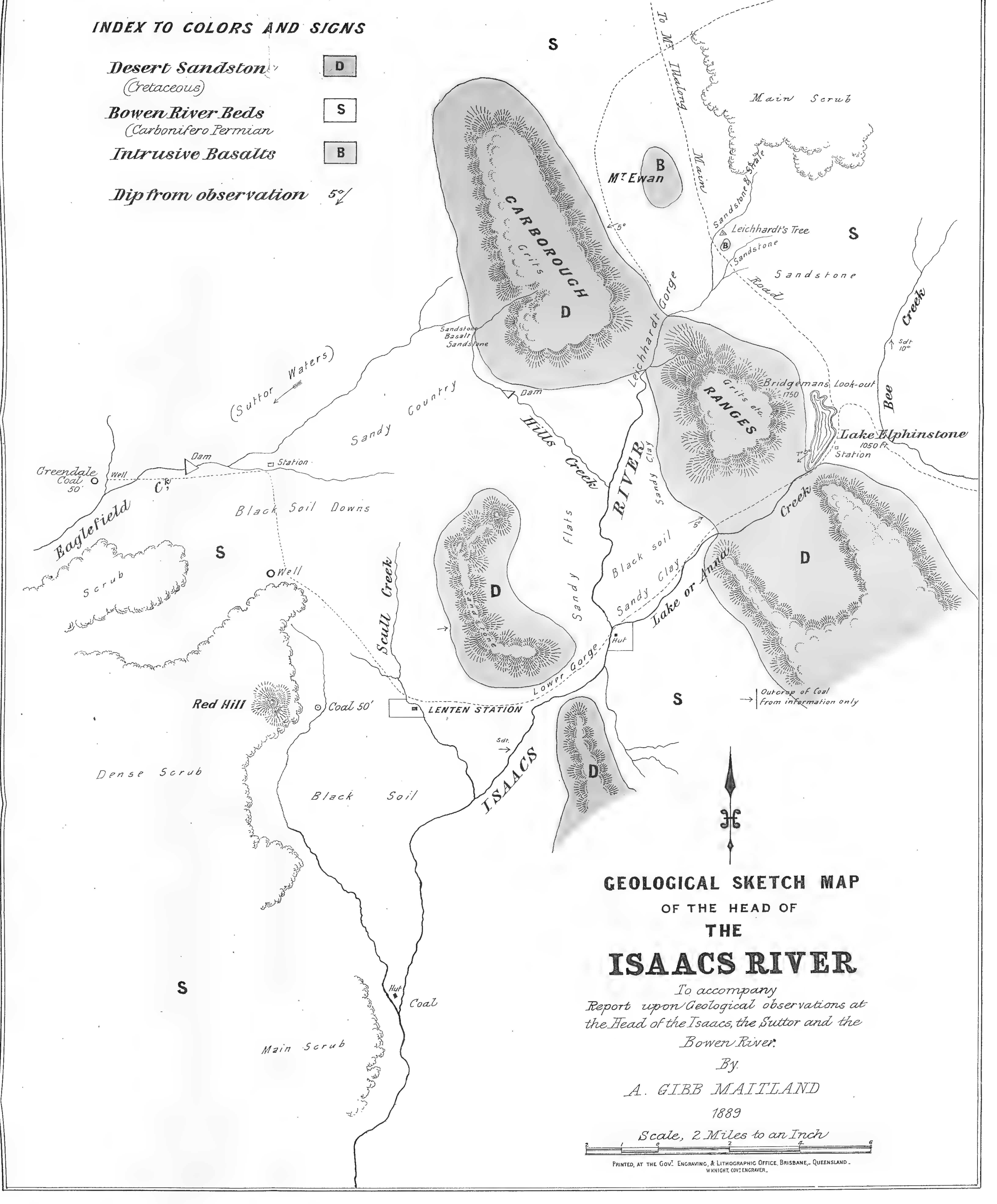
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Dip from observation 5°
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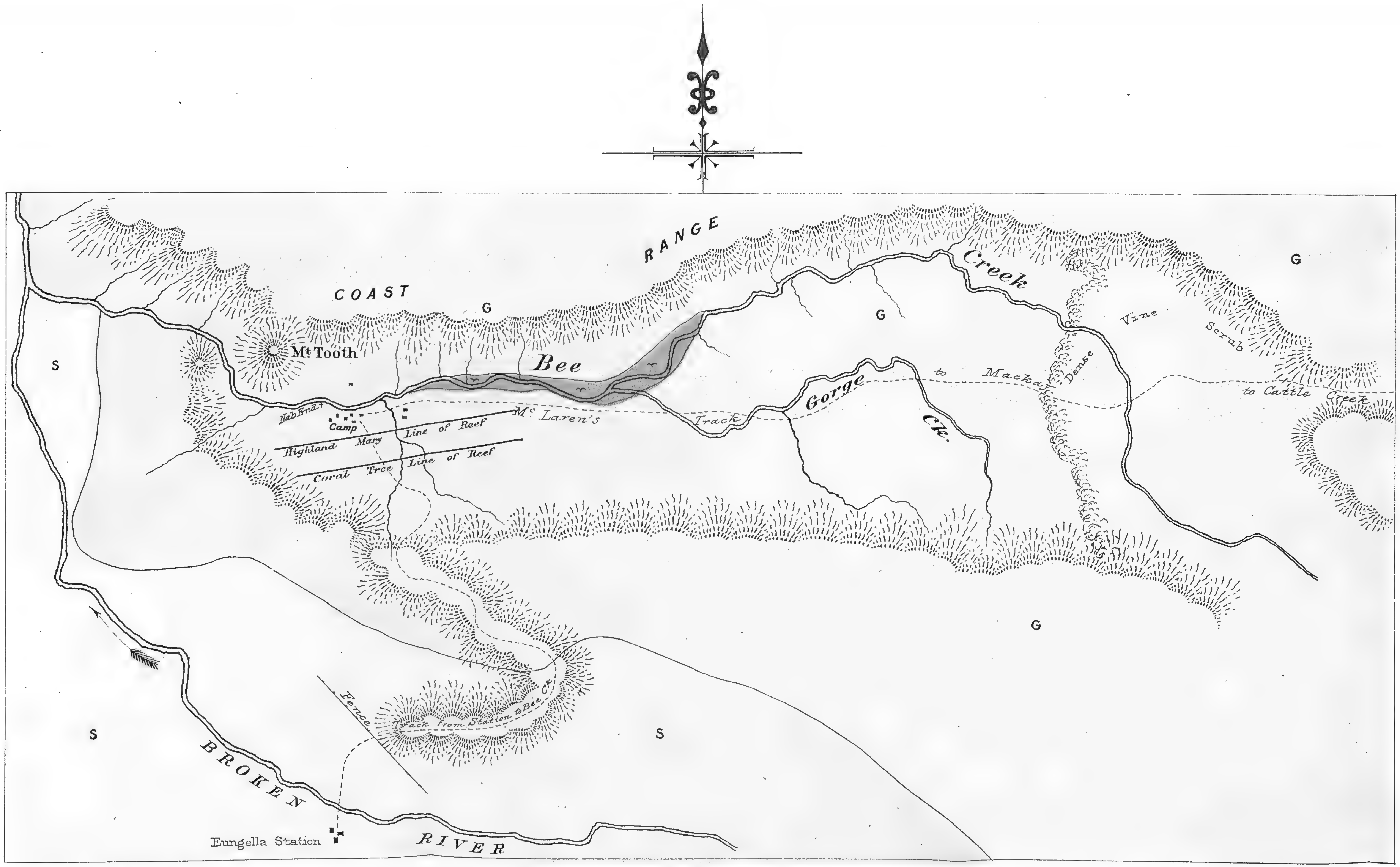
Main Scrub
Main Road
Mt Ewan
B
CARBOROUGH
Grits
D
Sandstone & Shale
Leichhardt's Tree
Sandstone
Sandstone
Road
Leichhardt Gorge
Sandstone Basalt Sandstone
(Suttor Waters)
Sandy Country
Dam
Hills Creek
Grits etc.
RANGES
Bridgemans Look-out 1750
Lake Elphinstone 1050 Ft
Station
Bee Creek
Sdt 10°
Greendale Coal 50'
Well
Dam
Station
Eaglefield Ck
Black Soil Downs
RIVER
Sandy Clay
Sandy flats
Black soil
Sandy Clay
Creek
D
Scrub
S
Well
Scull Creek
D
Lake or Anna
Hut
Lower Gorge
Red Hill
Coal 50'
LENTEN STATION
S
Outcrop of Coal from information only
Sdt.
ISAACS
D
Dense Scrub
Black Soil
S
Hut
Coal
Main Scrub
S
GEOLOGICAL SKETCH MAP
OF THE HEAD OF
THE
ISAACS RIVER
To accompany
Report upon Geological observations at the Head of the Isaacs, the Suttor and the Bowen River.
By
A. GIBB MAITLAND
1889
Scale, 2 Miles to an Inch
2 1 0 2 4 6
PRINTED, AT THE GOVT. ENGRAVING, & LITHOGRAPHIC OFFICE, BRISBANE, QUEENSLAND.
W. KNIGHT, GOVT. ENGRAVER.



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Alluvium ---------------------

Topography – J. S. Wilson.
Geological Features – A. Gibb Maitland

Line of Reefs.

GEOLOGICAL SKETCH MAP of BEE CREEK DIGGINGS

½ ¼ 0 ½ 1 2 3 4

1889

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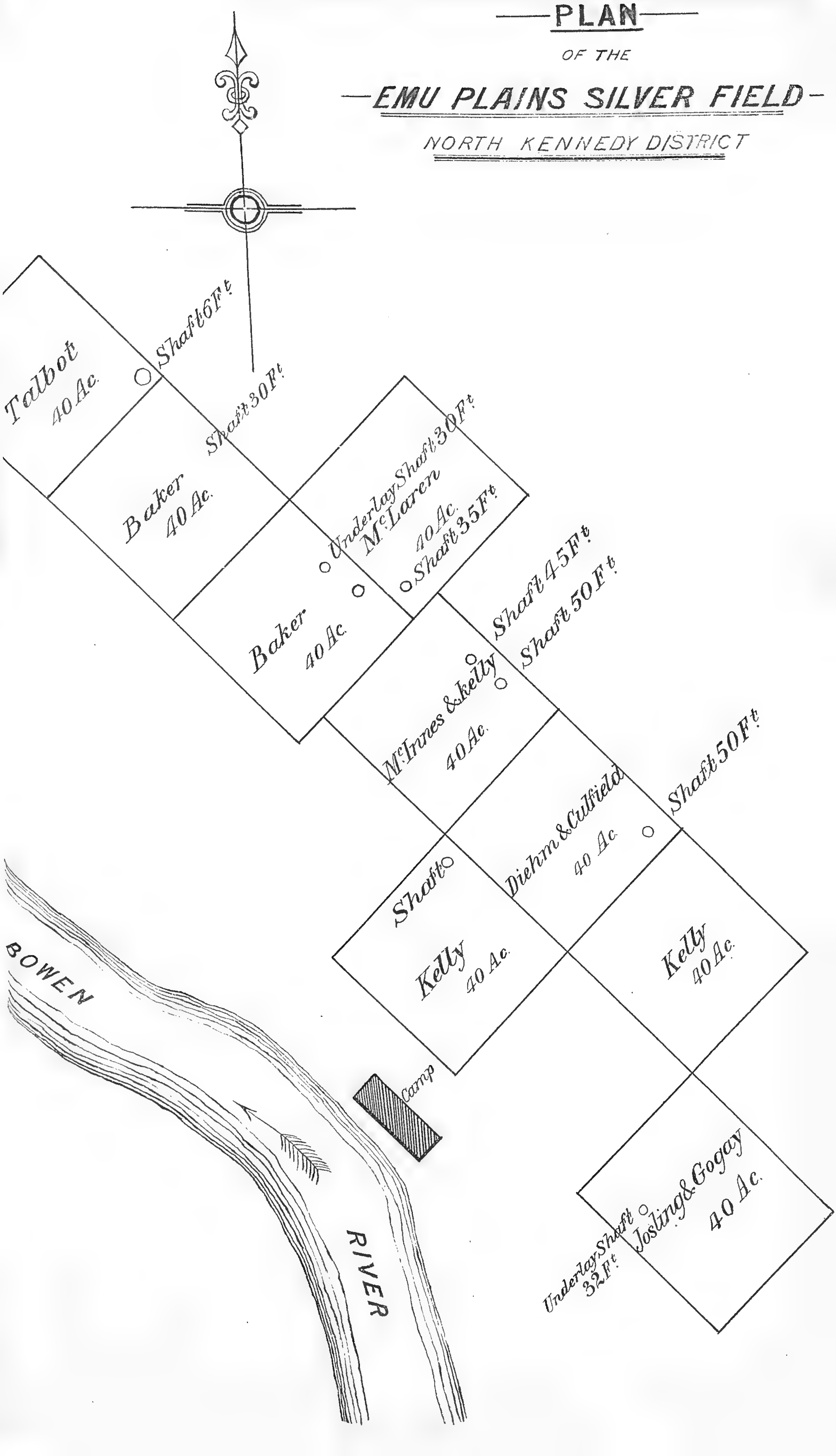
PLAN
OF THE
EMU PLAINS SILVER FIELD
NORTH KENNEDY DISTRICT
Talbot
40 Ac.
Shaft 6 Ft
Shaft 30 Ft
Baker
40 Ac.
Underlay Shaft 30 Ft
McLaren
40 Ac.
Shaft 35 Ft
Baker
40 Ac.
Shaft 45 Ft
Shaft 50 Ft
McInnes & Kelly
40 Ac.
Diehm & Culfield
40 Ac.
Shaft 50 Ft
Shaft
Kelly
40 Ac.
Kelly
40 Ac.
Camp
BOWEN
RIVER
Underlay Shaft
32 Ft
Josling & Gogay
40 Ac.

REPORT on ROCK and other SPECIMENS from NEW GUINEA, &c.—*continued.*

No.	Marks.	Names and Remarks.
19	Teste Island.—14-1-89	Grey limestone (good for mortar or as a building stone), and calcareous shale. [Fossils would probably be found in these and would be gratefully received.—R.L.J.]
20	Ferguson Island, Straits. West foot of Maybole Mt. (?).—7-11-88. Slate mica	Highly micaceous gneiss.
21	Normanby, 2nd Anchorage—Dolomite (?). River Glen.—28-10-88	Limestone. Would make a very fine building stone.
22	Samarai.—30-1-89	Numerous fragments of weathered dolerite, and a large piece of quartzite containing patches of arsenical pyrites.
23	Ferguson Island, West End, Hughes Bay—Slate and quartz.—5-11-88	2 fragments weathered dolerite, the larger with masses of mica adhering, and apparently from the junction of dolerite with a metamorphic rock, 1 fragment of fine-grained gneiss, and 1 fragment of quartz.
24	Goodenough Island, Dawson's Straits—Micaceous schists.—7-11-88	Mica schist and weathered fragments of an altered conglomerate.
25	High Island—Quartz, slate veins.—10-10-88	Quartz and 2 fragments of siliceous slate. The quartz gives a faint trace of gold by the iodine test.
26	Well Island.—2-11-88	2 specimens pitchstone, 1 of basalt, and 1 (weathered) of trachyte. (?)
27	N.W. coast Normanby Island—River bed wash.—1-11-88	Re-cemented granite debris, with a few fragments of pitchstone.
28	Sudest—River sand and gravel.—18-10-88 ...	Pebbles of slate, schist and quartz, and broken fragments of orthoclase felspar crystals, probably out of a granite. (*See* Mr. Clarke's Notes.)
29	Sudest River—Gravel and clay.—18-10-88...	Besides dry clay, fragments of slate schist and quartz. (*See* Mr. Clarke's Notes.)
30	Milne Bay—Stones and Gravel. Both sides range.—26-1-89	An iron oolite consisting of agglutinated concretions of iron peroxide, and debris of the same. NOTE.—The apparent low specific gravity of the stone is due to the open spaces between the concretions.
31	Normanby Island, 2nd Anchorage—River gravel.—28-10-88	Fragments of slate, schist, and quartz, and a few broken orthoclase felspar crystals.

Notes on Sand and Gravel, Sudest River.

The quartzes are but little worn.
Worn fragments of schist.
" slate.
Titannic iron.
Specular "
3 pieces of white glass, one worn.
1 shell.
3 or 4 minute but perfect quartz crystals.
No gold, tin, gems, or anything of value.

Notes on Gravel and Clay from Sudest River.

Quartz.
Schist.
Slate.
Abundance of clay.
2 pieces of glass.
No gold, tin, gems, or anything of value.

PETROLOGICAL NOTES ON TWO SAMPLES OF ROCK FROM NEW GUINEA.

No. 1 marked Pitchstone, Ferguson Island, Dawson Strait.

This sample is very much cracked, the cracks radiating round centres which consist of quartz crystals in every case. The colour is pitch black and very lustrous. To the naked eye quartz crystals alone can be detected in the black magnea. The radiating cracks are seen to the best advantage on the cut face. One such crack is depicted in the drawing annexed, No. 1. Across the south-west corner of the crystal a crack is shown extending into the homogeneous glass on either side. The glass enclosures with gas pores are well shown in the drawing. The sections only show felspars (sanidine) and quartz under a low power; between crossed nicols a distinct evidence of fluxion structure can be traced.

In drawing No. 2, the enclosures in the tabular felspars are shown but under the inch; the field is too small to give evidence of fluxion.

The glass is perfectly transparent grey and, of course, isotropic between crossed nicols. There appear to be no other minerals present.

No. 2, Basalt, Goodenough Island, Moresby Strait.

Vesicular with minute augite and felspar crystals visible to the naked eye. Under the microscope between crossed nicols, augite crystals are seen in plenty with glass enclosures and magnetite. The augite is well marked as shown in Drawing No. 3. The sanidine crystal in the same drawing shows growth by accretion in a very beautiful manner. The ground mass is so opaque that minute plagioclose crystals not thick enough to reach through and touch each surface of the section do not appear by transmitted light at all, while by reflected light a very large number of minute pellucid crystals can be observed.

GEOLOGY.

REPORT ON GEOLOGICAL SPECIMENS, BY ROBERT L. JACK, Esq., AND BY A. W. CLARKE, Esq.

Townsville, 5th June, 1889.

SIR,—I have the honour to enclose herewith Report on the specimens from New Guinea and neighbouring islands forwarded with your letter of 7th February last, together with Petrological notes on two of the rock specimens and notes on Sands and Gravels by Mr. A. W. Clarke, late Government Mineralogical Lecturer, who was good enough to prepare sections and examine them with the microscope.

The specimens are held at your disposal.

In compliance with your request I send, through Burns, Philp, and Co., as per enclosed shipping receipt, a parcel containing labels and 200 bags for specimens.

The specimens reported on tell no connected tale such as would enable one to construct even a theory regarding the geology of the islands. They show, however, that palæozoic rocks, such as are the matrices of gold and other metallic deposits in Australia and elsewhere, are abundant, and that basaltic lavas are of common occurrence. The limestones may yield fossils which would be of great service in unravelling the structure of the islands.

It will be seen from the Report that four of the quartz samples give traces of gold by the iodine process, and this is of importance. Permit me to recommend that you should impress on prospectors the importance and simplicity of this test, which will detect the presence of gold in quartz or pyrites, even though present in such minute quantities as to be invisible in a dish "prospect" with the most careful manipulation. The "tincture of iodine" of medicine is the only re-agent required, and the only apparatus necessary is a few test tubes, a spirit lamp, a glass funnel, white blotting paper, and asbestos. Iodine is dissolved in alcohol till the solution is of a rich, but not too dark, port wine colour. The powdered mineral is then put in a china or glass dish, with its own bulk of the solution, and occasionally stirred for two hours. The solution is next decanted and filtered, and a bunch of asbestos fibres of the thickness of a penholder dipped into it. The asbestos (held with pincers) is then pushed into the flame of a spirit lamp. A purple tinge on the asbestos, after the spirit has been burnt off, is a certain indication of the presence of gold in the mineral. The asbestos may be soaked and burned twice, or oftener, should the reaction at first be doubtful.

I have, &c.,

ROBERT L. JACK.

His Excellency Sir W. Macgregor, K.C.M.G.,
Administrator of British New Guinea.

REPORT on ROCK and other SPECIMENS from NEW GUINEA and Neighbouring ISLANDS.

No.	Marks.	Names and Remarks.
1	Mount Kilkerran, north side—Base rock, slate quartz.—3-11-88	1 specimen quartzose mica schist and 4 specimens reef quartz, which gives no trace of gold by the iodine test.
2	North-east St. Aignan—Trachyte (?) slate quartz.—21-10-88	5 specimens finely laminated indurated micaceous sandstone or quartzite, and 1 specimen of a much weathered felspathic rock, probably a volcanic tuff.
3	Slate and quartz—Joannet.—10-3-88 ...	1 specimen weathered mica schist marked "Johnnet Harbour," and 1 specimen reef quartz of unpromising appearance.
4	Pumice and Pitchstone—Ferguson Island, Dawson Straits.—31-10-88	Pumice and pitchstone. (*See* Mr. Clarke's notes, No. 1.)
5	Rossel Island, river boulder—Quartzoze.—10-10-88	In fragments. Looks like a micaceous quartzite, with vein quartz adhering.
6	Sudest Island, river bed—Slate and quartz veins.—10-10-88	Micaceous slate with a little quartz adhering.
7	Veins in sandstone—High Island.—10-10-88	One sample is a fine-grained sandstone of mixed siliceous and felspathic material. Two others are of vein quartz, one of them coloured greenish yellow by protoxide of iron. The quartz gives no trace of gold by the iodine test.
8	Dividing Range, Milne Bay.—14-1-89 ...	Basalt.
9	Tauputa River.—15-1-89	2 samples of compact white marble, and 1 of reddish clay slate.
10	Rossel Island—Slate and quartz.—16-10-88	Slate and vein quartz, which gives a trace of gold by the iodine test.
11	Logea.—29-1-89	Basalt.
12	Slate and quartz veins, South Rossel Island.—16-10-88	Slate and quartz veins. The quartz does not look promising, but gives a trace of gold by the iodine test.
13	St. Aignan—Lime conglomerate quartz slate, Middle Range.—23-10-88	Apparently a very recent beach deposit. The conglomerate contains quartz and slate pebbles and fragments of shells. Its matrix is apparently derived from the waste of basalt and slate, and is slightly calcareous, being full of comminuted shells.
14	Sudest River Bed—Slate and quartz.—16-10-88	Slate with small quartz vein adhering.
15	North Normanby—Porphyry (?).—1-11-88...	Weathered granite.
16	Rocks—Dividing Range, Mullin's Harbour and Milne Bay.—29-1-89	Hard compact mudstone, a piece of calcareous tufa with shell fragments, and the "stone" of a fruit.
17	Moresby Straits Goodenough Island.—9-10-88	Vesicular basaltic lava. (*See* Mr. Clarke's notes, No. 2.)
18	Slade Island.—10-1-89	11 pieces dolerite (basalt but macro-crystalline), 2 of acidic felstone, and 3 probably the same but weathered beyond recognition.